

Chapter 4: Environmental Consequences

It is a general rule in natural resource agencies that there is always more money for management activities than for research. Given this situation, it follows that resource managers should utilize management actions as experiments and opportunities to observe the response of the vegetation.

In the meantime, the public must recognize that resource managers are under severe pressure to act, and must justify their actions to a broad constituency. Resource managers in turn must acknowledge the complexity of the systems they are managing, and the impossibility of being able to predict if a particular research plan would be optimal, or even if it will be able to achieve the stated goals. Resource managers necessarily make decisions with partial information, on the basis of poorly tested hypotheses, and sometimes on pure speculation. The challenge is to integrate resource management activities and research without losing the capacity for critical examination and rigorous testing of ideas, which is the only means by which we will advance our knowledge of the complex ecosystems in which we work (P.H. Zedler).

Fire is a key evolutionary force that has influenced the Klamath ecosystems for millennia. Fire suppression has altered fire regimes, including its role as an evolutionary force, and created conditions that are very different from historic ecosystems. Human habitation in the wildland urban interface zones with existing wildland fuel conditions pose significant threats to human life and property; federal, state and county financial resources; wildlife and fish habitats; and socially valued ecosystems (Sierra Nevada Science Review 1988).

Concept of impact analysis

The purpose of this chapter is to present to the reader an analysis of what impacts can be expected under each of the alternatives discussed in this draft document. Through presenting impacts analysis, the reader—and decision-makers—would be better prepared to weigh advantages and disadvantages of the alternatives. Since a fire management plan is in fact a component of a vegetation management strategy, a great deal of this chapter focuses on the impacts of the various alternatives to the plant communities in Whiskeytown. The diversity of plant communities in the park and the manner in which they intergrade with each other present the writers of this document with a significant challenge—chiefly, how to best present the information in this chapter in a manner that allows full discussion of impacts, but also facilitates a clear understanding between each of the alternatives.

The pattern of analysis for this chapter is presented in outline form below:

- Affected environment
- Methodology and standards associated with the affected environment
- Regulation and policies governing management of the affected environment
- Fire management plan alternatives
- Fire management action
- Impact issues
- Type, context, duration, intensity, and mitigations

Each affected environment topic is introduced and followed by a short discussion of the methodology or standard most appropriate to use in assessing impacts. A brief section on government regulations and policies concerning the affected environment follows. Then each of the actions within an alternative is discussed in terms of their impacts on the affected environment topic.

Definition of terms

This chapter uses commonly accepted terminology to discuss environmental impacts. For the purposes of this document, a rough definition of terms follows to assist the reader in tracking differences between each of the alternatives. These rough definitions are presented for the benefit of the reader to understand the approach used to analyze impacts. The definitions are generalized—impacts are better discussed below according to each specific affected environment.

Type of impact

Adverse impacts are those that change the affected environment in a manner tending away from the natural range of variability.

Beneficial impacts are those that change the affected environment toward the natural range of variability.

Context of impact

Direct impacts include such impacts such as animal and plant mortality, damage to cultural resources, or creation of smoke, that occur at the time and place of the action.

Indirect impacts are those that occur at a different time and/or place than the action. Indirect impacts include changes such as species composition, structure of the vegetation, or range of wildlife. Indirect impacts also include impacts that occur off- site such as erosion- related impacts, or general economic conditions tied to park activities.

Cumulative impacts are the combination and interaction of individual direct and indirect impacts on the affected environment, both by the actions proposed in this document, and all previous actions, such as dam- building, developments, and logging.

Duration of impact

Generally, each affected environment has different time scale associated with the duration of an impact.

Short- term impacts are those that can be reversed relatively quickly. For the most part, short-term impacts are those that would be reversible during the period covered by this plan (approximately seven to ten years).

Long- term impacts are those that are reversed much more slowly. Longer- term impacts are those that would be reversible beyond the period covered by this plan (seven to ten years).

Intensity of impact

Negligible impacts are imperceptible or undetectable.

Minor impacts are slightly perceptible and localized.

Moderate impacts represent a notable change on a local basis.

Major impacts represent substantial changes on a landscape scale.

Mitigation of impacts

Avoid conducting management activities in an area of the affected environment.

Reduce the type of impact to an affected environment.

Minimize the duration or intensity of the impact to an affected environment.

Repair localized damage to the affected environment immediately after an adverse impact.

Rehabilitate an affected environment with a combination of additional management activities (i.e. planting trees in shaded fuel breaks, inoculating eroding soil with mycorrhizae and mulching).

Compensation of a major long- term adverse direct impact through additional strategies designed to improve an affected environment as much as is practical.

Biological environment

This section addresses impacts affecting plants and animals, including special status plants and animals, and invasive species. Fire management activities such as administration staffing, education and relocation of the fire cache and construction of a new administration building at park headquarters are not expected to have any noticeable impacts on the biological environment. New building construction will occur only within already developed sites within either the Oak Bottom compound or the park headquarters compound.

Vegetation communities

The patchy vegetation patterns in the park reflect variables such as elevation, topography, soil types, and natural and human disturbances. As noted in Chapter 3, for the purposes of this draft document, the diverse habitats have been grouped into seven plant communities; mixed conifer, ponderosa pine, knobcone pine, mixed oak woodland, blue oak grasslands, chaparral, and riparian.

Type of impact

Adverse impacts are those that change the plant communities in a manner tending away from the natural range of variability.

Beneficial impacts those that change the plant communities toward the natural range of variability.

Context of impact

Direct impacts include such impacts such as mortality of individual species or entire plant communities.

Indirect impacts are the alteration of the affected environment, individual plants, or plant communities which result in beneficial or adverse impacts after the time of the action, or in a location different from the action. These alterations encompass such changes as species composition or structure of the vegetation, erosion- related impacts, or impacts that occur long after the action.

Cumulative impacts are the combination and interaction of individual direct and indirect impacts on the affected environment in addition to all prior actions.

Duration of impact

Short- term impacts are those that can be reversed relatively quickly. Short- term impacts are those that would be reversible during the period covered by this plan (approximately seven to ten years).

Long- term impacts are those that are reversed more slowly. Long- term impacts are those that would extend beyond the period covered by this plan (seven to ten years).

Intensity of impact

Negligible impacts are imperceptible or undetectable impacts upon plants or plant communities.

Minor impacts are slightly perceptible and localized to an individual plant or plant community.

Moderate impacts represent changes that would notably impact vegetation, and/or vegetation processes and associations. Impacts may be to individual plants, plant communities, or plant associations.

Major impacts represent substantial changes that would alter vegetation processes, associations, and ecological functions on a landscape scale, or on a small- scale if rarity of the species were a factor.

Methodology and standards

Park staff through a review of available literature, discussion, experience, consultation, and professional judgment completed the analysis of vegetation communities. The standards used to analyze the impacts were developed through interdisciplinary team discussions and outside assistance.

Regulation and policies

There are a number of regulations and policies that affect vegetation in a national park. As with all Federal agencies, the Endangered Species Act and the Executive Order 13112 on Invasive Species issued February 3, 1999 play major roles in management methods. In addition, the National Park Service Management Policies (2001) define exactly what issues that parks must

consider, unique to the National Park Service, in relation to laws and policies of the Federal government.

Mixed Conifer Community

Issues and Impacts Common to All Alternatives in Mixed Conifer Community

Suppression

Construction of fire lines, helispots, safety zones and spike camps during suppression activities would result in mortality of individual plants and trees. Construction methods range from the use of hand tools to bulldozers. These direct impacts range from beneficial to adverse, short- term to long- term, and from minor to major depending on the size, intensity and location of the fire and the type of line- cutting activity. Cutting fire lines with hand tools will have direct, long- term, major impacts to the individual non- sprouting plants that would be killed, but only minor to moderate adverse impacts to the plant community. The use of bulldozers would result in much more significant adverse impacts to vegetation and soils than cutting line with hand tools. The dozer line impacts would be moderate to major, and usually long- term.

The felling of large trees to facilitate fire suppression activities would result in direct, adverse, minor to major, long- term impacts. Intensity and duration of impact would vary depending on specifics. While the killing of large trees is thought to be detrimental to plant communities and associated wildlife, and is certainly a long- term action adverse to individual trees, the felling of one or two large trees would have a direct, minor impact to the community. The felling of a few large trees would have a direct, moderate impact, while the mortality of many large trees would be a direct, major impact.

Water drops from aircraft and high- pressure hoses used to suppress fire would result in mortality or damage to vegetation from the impact of the water. The impacts are expected to be direct, adverse, negligible to moderate, and short to long- term, depending on site specifics such as quantity and force of the water, degree of slope, and rarity of plants affected.

Most studies show the application of fire- fighting chemicals such as retardant and foam has impacts on vegetation. Impacts include decreased species richness, increased biomass, increase in density of exotic grasses, decrease in nitrogen- fixing native legumes, and decreased stem density. These impacts are for the most part indirect, adverse, short- term and negligible to moderate. (More significant impacts occur in aquatic environments to invertebrates, algae, and fish).

Fuel accidentally spilled during fire suppression activities may kill vegetation. Impacts would be direct, adverse, and negligible to major, and short to long- term depending on the size and location of spill. A very large spill, although unlikely, may result in the removal of hundreds of cubic yards of soil, and the death of many plants which would be considered direct and indirect, adverse, moderate to major, and long- term. A small spill that affects only a few plants would be considered minor to moderate and short- term. In the event a population of rare plants is decimated, the impact would be major and long- term.

Burn- outs and back- burns conducted as fire suppression activities would result in direct mortality and damage to vegetation as it is killed or damaged by burning. Intensity and duration of adverse impacts would range from negligible to moderate, and short to long- term depending on site specifics, fire spread, heat generation, and type and density of vegetation. A slow moving ground fire may affect only the herbaceous understory and a few shrubs, leaving most of the overstory untouched. Such impacts would be considered direct, adverse, short- term, and moderate, while a very fast moving hot fire could potentially burn all the vegetation, sterilize, soil,

and inhibit reproduction for many years. While recovery would occur in the long run, these impacts could be considered direct, adverse, major, and long- term. From a standpoint of ecosystem health, however, these impacts could be considered beneficial. Impacts of burn- outs and backburns would be considered indirect, beneficial, moderate to major, and long term with regard to their effectiveness in the prevention or moderation of large, high severity fires.

Soil disturbance and compaction from suppression activities would result in mortality and damage to mycorrhizae and other beneficial soil microorganisms. These impacts would be direct and indirect, adverse, with negligible to moderate intensities and short to long- term duration depending on site specifics such as degree of disturbance and amount of litter left on the forest floor.

Fire suppression reduces the potential for high- severity fire and subsequent severe fire impacts. This impact would be considered indirect, beneficial to adverse, moderate to major, and long- term.

Wildland fire suppression has adverse impacts because the beneficial impacts of fire are eliminated. The potential for high- severity fire would be increased because the fire was not allowed to burn and decrease fuel loads. Impacts would be indirect, adverse, negligible to major, and short to long- term.

Line cutting would have impacts similar to thinning. While killing individual plants and trees would be direct and adverse to those individuals, the indirect impact of line- cutting would be moderately beneficial in the overgrown mixed conifer community.

Impacts from burn- outs and back- burns conducted as fire suppression activities can be adverse or beneficial. Beneficial, indirect impacts include the beneficial impacts of fire and halting the spatial extent of a high severity fire. Conversely, adverse, indirect impacts would occur under conditions in which a back- burn burns more intensely than intended and results in high- severity impacts. These impacts could be short to long term, and minor to major.

Fire line construction activity and the presence of fire crews would cause damage to vegetation that is not directly killed by line- cutting suppression activities. Damage to vegetation during suppression activities may result in mortality at a later time or decreased vigor due to damage. These indirect impacts could be beneficial to the mixed conifer community in that some thinning of overgrown communities is desirable. Damage or mortality to individual plant specimens would be direct, and adverse to that particular plant, and possibly indirectly as a whole if many, most, or localized populations suffer mortality, and/or damaged in such a way that no reproduction is possible. Degree of impacts would be minor to major, and duration short to long- term.

The application of retardant containing fertilizers may increase number or population densities of exotic species. Few studies are available, but most of them show increased populations of exotics, particularly grasses. These impacts appear to be short- lived in the few studies available. This effect would be indirect, adverse, and negligible to moderate, short to possibly long- term depending on species. More data is needed on retardant impacts on exotic as well as native species. The use of retardants may affect individual plant health and plant community composition. These impacts would be indirect, adverse, negligible to moderate, but probably short- term depending on species.

Fire crews and equipment may introduce or spread exotic species through propagules on boots, vehicles, or equipment, and spread may be exacerbated by disturbance activities related to suppression. Exotic plant species may out- compete and replace native plant species in some

areas. These impacts would be indirect, adverse, negligible to major, short to long- term impacts, depending on species, amount of seed transferred, and site specifics such as germination, rates, and moisture regimes.

Suppression activities would alter habitat through removal of individual plants and alteration of site characteristics such as soil, light and moisture. Habitat alterations would include habitat that contains sensitive plant species. While it may be surmised that sensitive plants are adapted to fire, or may not be affected due to their location, more data is needed. Impacts could be direct or indirect, beneficial or adverse, negligible to major, and short to long- term.

Suppression activities have the potential to contribute to bark beetle or fungal infestations or other pathological processes as a result of injury to trees while conducting suppression activities. These impacts would be indirect, adverse, negligible to moderate, and short to long- term.

Habitat would be altered in areas where firelines, spike camps and helipads are constructed, and as a result of burnout/backburn activities. Habitat alterations would include changes in species composition, structure and function. These impacts would range from direct to indirect, beneficial to adverse, negligible to moderate, and short to long- term, depending on species and degree of damage.

Vegetation in areas of soil compaction from suppression activities may exhibit reduced regeneration and vigor. These impacts would be indirect, adverse, negligible to moderate, and short to long- term, depending on species and degree of compaction.

Fuel spills or incomplete combustion of ignition compounds during suppression activities may impact vegetation. Large fuel spills may require removal of substantial amounts of native soils and vegetation and destruction of seed bank. These impacts would be direct or indirect, adverse, negligible to major, short to long- term impacts, depending on species and size and extent of spill.

Mortality and damage to mycorrhizae and other soil microorganisms during suppression activities may have adverse impacts to residual vegetation and regeneration. These impacts would be indirect, adverse, negligible to moderate, and short to long- term impacts, depending on species and degree of damage.

Sensitive plant species as well as old- growth trees are protected from fire where fire is suppressed; however, fire- adapted sensitive species may not do well if fire is suppressed. These impacts would be indirect, beneficial to adverse, negligible to major, and short to long- term. More data is needed.

The potential for deforestation related to severe wildland fire would be eliminated or reduced if suppression activities were successful. This impact would be indirect, beneficial, major, and long- term.

Lack of fire as a result of fire suppression alters the composition, structure, and function of the mixed conifer plant community. The natural fire cycle is interrupted, and fire adapted species would decrease over time as a result of fire suppression. Long- term fire suppression has resulted in increased fuel levels and thus fire hazard in the mixed conifer vegetation community. These impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management actions. These impacts are cumulative, adverse, moderate to major, and long- term.

Prescribed Fire

Mortality and damage to vegetation would occur during pre- fire thinning and construction of prescribed fire burn unit boundaries. These impacts would be direct, adverse to beneficial, negligible to major, and short- term.

Mortality and damage to vegetation would occur as a result of management- ignited fires. These impacts may be adverse in areas where the fire exceeds prescribed parameters, but overall would be beneficial in that prescribed fire mimics natural fire in the ecosystem, creating gaps and increasing habitat diversity. Impacts would be direct, negligible to major, and short to long- term.

Sensitive/uncommon plant species present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey and avoided. Some herbaceous species may thrive as a result of disturbance, while tree species such as McNab Cypress continue to decline due to thinning activities. These impacts could be direct, adverse or beneficial, negligible to major, and short to long- term, depending on the requirements of specific species, and the degree of impact.

Plant reproduction may be negatively impacted by the loss of seeds or other propagules such as acorns or bulbs. Seasonality may exacerbate this impact. Prescribed fire and pre- burn activities in the spring may kill plants, seeds and bulbs that would survive a similar burn in the fall, during the dormant season. These impacts would primarily be adverse but could be beneficial if reproduction is slowed in undesirable species such as exotic plants. These direct impacts would range from negligible to major, and short to long- term, depending on the requirements of particular species.

Fire would trigger germination of fire- adapted plants. This impact would be largely beneficial as it is a component of natural fire regimes. Impacts would be direct, negligible to moderate in intensity, with short to long- term impacts. This impact would be adverse if germination is triggered in exotic species (see indirect, below, for exotic plant impacts).

Prescribed fire escapes may become wildland fire; with possible undesirable, high- severity fire impacts. While these impacts would be adverse to developments, they would be beneficial to the ecosystem in the long- term. These direct impacts would range from negligible to major, and short to long- term depending on size, location and intensity of the escaped wildland fire.

Fuel spills that occur during prescribed fire activities may impact vegetation. Large fuel spills may require removal of substantial amounts of native soils and vegetation and destruction of seed bank. These impacts would be direct and indirect, adverse, negligible to major, and short to long- term.

Fires would decrease nutrient availability and organic matter. This impact may be seen as adverse, but is likely to be beneficial in the long- term as it is a normal component of fire- adapted ecosystems. Loss of nutrients and litter and duff may favor certain pioneer species that are essential to post- fire recovery. These impacts would be direct and indirect, negligible to moderate, and long- term.

Fuel spills that occur during suppression activities may impact vegetation that is not burned during the fire. Large fuel spills may require removal of substantial amounts of native soil and vegetation and destruction or removal of the seed bank. These impacts would be indirect, adverse, negligible to major, and short to long- term depending on species, and size and extent of spill.

The seeds of exotic plant species may be transferred to new areas inside prescribed burn units. Exotic annual grasses can increase the probability of ignition and spread of wildland fires and may compress the fire return interval. These impacts would be indirect, adverse, negligible to major, and short to long- term, depending on species, degree of infestation, and ability to treat infestation.

Some mortality of vegetation damaged during pre- fire and prescribed fire activities can be expected. While impacts are adverse to individual species, the beneficial impact of prescribed fire would outweigh the adverse impacts. These impacts would be indirect, negligible to moderate, and short to long- term.

Vegetation in and around burn piles, including sensitive species and overstory trees, may be damaged or killed if proximity of the pile or intensity of the fire is inappropriate. These impacts would be indirect, adverse, minor to major, and short to long- term.

Prescribed fire activities have the potential to contribute to bark beetle or fungal infestations or other pathological processes as a result of injury to trees resulting from suppression activities. These impacts would be indirect, adverse, negligible to moderate, and short to long- term.

Soil disturbance/compaction as a result of prescribed fire actions such as boundary line construction, crew activity, and burning piles may result in increased exotics, and/or decreased native plant vigor. These impacts would be indirect, adverse, negligible to major, and short to long- term.

Prescribed fire may escape, which would result in substantial mortality to mixed conifer community to an undesirable degree. While this impact may be seen as adverse, from the standpoint of the fire- adapted ecosystem, it would be a beneficial impact, even if it burns very hot and takes a very long time to recover. Impacts from escaped prescribed fire would be indirect, negligible to major, and short to long- term.

Thinning associated with prescribed fire would result in increased insolation and soil temperatures, and altered moisture regimes which would most likely result in decreased moisture availability. Some plants, especially herbaceous species, may decline rapidly due to loss of shade and moisture. Conversely, the new conditions may be favorable to other species whose populations may increase rapidly. These impacts would be indirect, beneficial to adverse, negligible to moderate, and short to long- term.

Prescribed fire would benefit fire- adapted species, and reduce overstocked understory trees and promote the growth of large, overstory species. This impact would be indirect, beneficial, moderate to major, and long- term.

Prescribed fire would reduce the potential for high- severity wildland fire by decreasing fuel loads, and reduce the intensity and severity of subsequent wildland fires. These impacts would be indirect, beneficial, moderate to major, and short to long- term.

Prescribed fire would enhance the growth and subsequent use of ethnobotanical plants. This impact would be indirect, beneficial, moderate, and long- term.

Prescribed fire would have long- term impacts on plants by either increasing or decreasing nutrient availability. These indirect impacts would range from beneficial to adverse, and be moderate, and short to long- term.

Prescribed fire activities may result in soils that are made sterile or hydrophobic by fire that burns very hot or by burn piles, which would inhibit re- growth of vegetation. This impact would be indirect, adverse, moderate to major, and short to long- term.

Prescribed fire alone cannot fully mimic the ecosystem functions of pre- settlement fire because forest structure and composition is significantly changed and prescribed fire impacts are quite different than those of pre- settlement fire. Several applications of prescribed fire may be necessary, especially in densely stocked stands with high concentrations of fuels. Thinning completed prior to prescribed fires can decrease the potential of large intense fires. These impacts would be adverse, moderate to major, and long- term.

Prescribed fire is expected to re- create a more natural fire regime in mixed conifer forests, along with reduced potential for crown fire and extreme fire behavior, and reduced fire intensity at a landscape scale. These impacts would be cumulative, beneficial, moderate to major, and long- term.

All of the above impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Mechanical Treatment Level 1

Level 1 mechanical treatment would result in mortality and damage to vegetation. While this impact would be adverse to the individual plants that are killed or damaged, the overall impact of reducing fuel loads and providing safety for prescribed burn operations would be beneficial. Impacts would be direct, negligible to major in intensity, and short to long- term.

Changes in species composition and vegetation structure would result from mechanical treatment. Indirect beneficial impacts would include the creation of more diverse habitat for a native species. Impacts would be negligible to major, and short to long- term, depending on site specifics.

Mechanical treatment level 1 would reduce and redistribute fuel loads, reduce crown bulk densities and decrease fire intensity. These impacts would be direct, beneficial, moderate, and short to long- term.

The potential for fuel spills and the impact on vegetation would be approximately the same as that described under prescribed fire, direct impacts.

The potential to cause damage or mortality to sensitive, or uncommon species would be approximately the same as that on under prescribed fire, direct impacts.

Some vegetation mortality is expected from damage that occurs during mechanical treatment. While this impact would be adverse to the individual plants that are killed or damaged, the overall impact of reducing fuel loads and providing safety for prescribed burn operations would be beneficial. Impacts would be indirect, negligible to major in intensity, and short to long- term, depending on site specifics and quantity of vegetation removal.

Mechanical treatment would result in habitat modification as a result of alterations to composition and structure. Beneficial impacts may be the creation of more diverse habitat for a native species, while adverse impacts may include an increase in exotic species. Impacts would be indirect, negligible to major, and short to long- term.

Mechanical treatment may result in an increase or an introduction of disease and pest infestations as a result of slash piles and inadvertent injury to trees during treatment. Indirect, adverse to beneficial, negligible to major, short to long- term impacts.

Reproduction may be slowed if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. These impacts would be adverse from the standpoint of ecosystem recovery and diversity but beneficial from a fuels reduction perspective. These indirect impacts would range from negligible to major, and short to long- term.

Mechanical treatment would reduce fire intensity, and reduce risk of severe crown fire. These impacts would be indirect, beneficial, negligible to major, and short to long- term.

Mechanical treatment would increase potential for wildland fire ignition as a result of canopy thinning making conditions favorable for annual grasses, and increased drying temperatures that contribute to ignition and spread of fire. These indirect impacts would be adverse, negligible to major, and short to long- term.

Mechanical treatment activities have the potential to damage vegetation if fuel spills occur during treatment activities. These indirect impacts would range from adverse to beneficial, negligible to major, and short to long- term.

Mechanical treatment would result in decreased probability of crown fire due to fuel reduction. This cumulative impact would be beneficial, moderate, and long- term.

Mechanical treatment would increase potential for annual grasses and other exotic species due to repeated thinning. This impact would be cumulative, adverse, moderate, and long- term.

Thinning impacts on nutrient cycling, seed scarification, plant and genetic diversity, disease and pest infestation are unknown (more data is needed).

Injuries to trees during thinning operations may make them more susceptible to disease. Adverse, moderate, short to long term impacts.

Thinning may increase growth and vigor of remaining plants. Beneficial, moderate, long term impacts.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Alternative I

Please review what is stated in the section above (Issues and Impacts Common to All Alternatives) for the environmental impacts of suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative I for the mixed conifer vegetation community.

Shaded Fuel Breaks

This action would result in increased mortality and damage to vegetation (larger scale removal than mechanical Level 1) and change species composition and vegetation structure resulting from goal of maximizing fuel reduction as opposed to re- creation of more natural forest composition

and structure. Would have direct, adverse and beneficial, negligible to major, short to long- term impacts.

Fuel levels would be reduced; and crown fire spread would be minimized. This impact would be direct, beneficial, negligible to major, and short to long- term.

This action has the potential to cause damage or mortality to sensitive species. Impacts would be approximately the same as previously discussed above.

Some vegetation would suffer inadvertent mortality from damage that occurred during treatment. These impacts would be indirect, adverse to beneficial, negligible to major, and short to long-term.

Habitat fragmentation would occur as a result of 100- foot wide swaths of altered vegetation. These impacts would be adverse to the ecosystem, but beneficial from a fire standpoint. Range of intensity would be indirect, negligible to major, and duration would be short to long- term.

Shaded fuel break construction has the potential to introduce or expand exotic plant populations. This impact would be indirect, adverse, negligible to major, and short to long- term.

Shaded fuel break construction increases the potential to introduce and spread disease and pest infestations. Depending on extent of infestation, these indirect impacts may be adverse or beneficial, negligible to major, and short to long- term.

Reproduction may be affected if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. Would have indirect, adverse to beneficial, negligible to major, and short to long- term impacts.

Shaded fuel breaks may increase or decrease the likelihood of wildland fire ignition, due to decreased fuels but increased exotic annual grasses and temperatures. Also expected are reduced intensity of fire, and reduced risk of large, severe wildland fire. These impacts would be indirect, adverse to beneficial, moderate, and short to long- term.

Treatment activities may result in fuel spills that impact vegetation. Impacts would be the same as those in previous discussion of fuel spills.

Shaded fuel breaks may result in increased recreation use of shaded fuel breaks as trails for hiking, biking, equestrian, motorized use, which would result in potentially serious accelerated erosion. This impact would be adverse, negligible to major, and short to long- term.

Long- term changes in composition, structure and function would occur. These would be cumulative, beneficial to the safety/fire component, but adverse to the ecosystem. Moderate to major intensities are expected.

Repeated treatments would increase the potential for the introduction and spread of exotic plants, disease and pest infestations. Cumulative impacts would be the same as in other vegetation communities.

Understory species, and those that were adapted to the pre- treatment conditions would be significantly reduced or eliminated. Cumulative impacts would be adverse, moderate to major, and long- term.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large, intense wildland fires. Short- term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions. Long- term adverse impacts are acceptable due to the beneficial impacts provided, and most long- term adverse impacts could be mitigated. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources would occur under Alternative I. Impairment of mixed conifer vegetation community would include loss of old- growth trees and forest characteristics, and irreversible soil damage to sensitive decomposed granite soils.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fire risk would increase over time as a result of the increase in hazardous fuels. Second growth stands in the mixed conifer community would continue to be overstocked, stressing overall stand health and increasing susceptibility to pathogens. The length of time required to return the mixed conifer community to that approximating the early 1800s would be longer under Alternative I than under other alternatives with a broader range of fire management tools.

There may be additional long- term impacts to mixed conifer communities related to management actions proposed for this alternative, particularly related to the reactive installation and irregular maintenance of a shaded fuel break network that cannot be predicted at this time.

Alternative II

Please review what is stated above in the Issues and Impacts Common to All Alternatives for the environmental impacts of suppression, prescribed fire and mechanical treatment Level 1. The direct and indirect impacts discussed in actions to common to all alternatives are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire. The direct and indirect impacts for mechanical treatment level 1 fore Alternative II are expected to have the same impacts as in Alternative I, but would occur mainly in prescribed fire burn unit boundaries. Discussed below are the impacts specific to Alternative II for the mixed conifer vegetation community.

Shaded Fuel Breaks

Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrow. Impacts would be direct, beneficial to the ecosystem, but adverse to fire objectives, negligible to major, and short to long- term.

Firefighter access routes and backfiring lines would have to be developed quickly, increasing the probability of bulldozers use. These impacts would be direct, adverse, negligible to major, and short to long- term.

Without shaded fuel breaks, crown fires have the potential to continue to burn without dropping down to a surface fire, thus increasing the difficulty of control, and the probability of large scale, high severity fire impacts. This impact would be indirect, adverse, negligible to major, and short to long- term.

No long- term changes in composition and structure would occur under Alternative II. Cumulative accumulation of high fuel loads would continue with the potential for large, high intensity, high severity fires. No potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions would occur under Alternative II. No potential for habitat fragmentation would occur as a result of the construction of linear features, since no shaded fuel breaks would be constructed under Alternative II. The potential for high- severity fire is increased over Alternative I since continuous distribution of high fuel loads across the landscape reduces potential to control size of fires.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Short- term use versus long- term enhancement of resources

Fire management activities under Alternative II would result in some mortality, but would reduce threat of large, intense, wildland fire, but may also increase the threat over the long run. Short- term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources would occur under Alternative II.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning could result in decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan (Alternative I). Shaded fuel breaks would not be maintained and plant regrowth would occur. The prescribed fire program would be expanded, and necessitate an increase in the number of spring burns to meet fuel reduction objectives. This alternative meets several of the park's stated fire management objectives. Reliance on prescribed fire as the primary tool for landscape vegetation restoration would require a longer period of time than other alternatives with a broader range of fire management tools. No impairment of mixed conifer vegetation community would occur under Alternative II. Examples of impairment include type conversion, or loss of old- growth forest.

Alternative III

Please review what is stated above for the environmental impacts of suppression and mechanical treatment level 1. In addition to what is described above for prescribed fire impacts, under Alternative III there would be reduced cumulative impacts, mainly through the use of pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives. Impacts would be the same as prescribed fire in Alternative I, but limited to pile burning impacts only. What follows is a discussion of the impacts specific to Alternative III for the mixed conifer community.

Mechanical Treatment Level 2

No mechanical Treatment Level 2 will occur in the mixed conifer community due to the potential for unacceptable adverse impacts to sensitive soils that would constitute impairment.

Shaded Fuel Breaks

Under Alternative III, width of shaded fuel breaks would be increased from 100 to 200 feet, and shaded fuel breaks would be reviewed to determine maintenance needs on a three year cycle. Appropriate maintenance requirements would be completed as needed according to this cycle. See Shaded Fuel Break direct impacts in Alternative I, above; impacts are expected to be similar but approximately doubled in scope since width of shaded fuel breaks is doubled.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality of vegetation in the short term, but would enhance vegetation in the long term by the reduced threat of high severity wildland fire.

Burn piles may escape to become wildland fires. However, the reduced risk of wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources would occur under Alternative III.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of mixed conifer vegetation community would include type conversion or loss of old growth forest.

Alternative IV

Review what is stated above (in Issues and Impacts Common to All Alternatives) for the environmental impacts of suppression, prescribed fire and mechanical treatment Level 1. Under Alternative IV, mechanical level 3 (small- scale logging) is added to mechanical level 1 and mechanical level 2. Wildland Fire Use is also added in the undeveloped areas of Fire Management Unit 2 (Backcountry).

Mechanical Treatment Level 2

Under this alternative, it is expected that there will be both beneficial, moderate, long- term changes in composition and structure.

Mechanical treatment level 3, small- scale logging, includes a higher intensity of impacts than Level 1 and Level 2 mechanical treatment. Mechanical level 3 will not occur in the Mixed Conifer plant community due to the potential degree of adverse impacts that would constitute impairment on the sensitive decomposed granite soils in the Mixed Conifer Community.

Shaded Fuel Breaks

Under Alternative IV, the number of shaded fuel breaks is expanded from the current management activities and the width is doubled to 200 feet along roads. Along ridges, the system stays the same as current standards. The Shaded Fuel Break system would be similar to that described in Alternative III, and impacts for shaded fuel breaks under Alternative IV would be the same as those described under Alternative III.

Wildland Fire Use

Wildland Fire Use (Wildland Fire Use) fires will result in mortality and damage to vegetation as a result of allowing wildland fires to burn. Wildland Fire Use fires have the potential to escape desired boundaries, and become a large, severe and unmanageable fire. Wildland Fire Use may damage or kill threatened, endangered, or sensitive species and large overstory trees. These impacts would be direct, adverse to beneficial, negligible to major, and short to long- term.

Wildland Fire Use fires may increase exotic species including annual grasses that contribute to the probability of ignition and spread of wildland fires and may compress the fire return interval. Exotic plant species may be introduced and spread within wildland fire units. These impacts would be indirect, negligible to major, adverse, and short to long- term.

Wildland Fire Use fires have the potential to escape desired areas and/or become high severity fires, resulting in substantial mortality to overstory trees. Indirect, moderate to major, adverse, short to long- term impacts. These fires may stimulate germination of fire- adapted native species and mimic natural fire in the ecosystem. These impacts would be indirect, beneficial, moderate, and long- term.

Wildland Fire Use reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires due to reduction in fuel loads and has the potential to enhance ethnobotanical uses. These impacts would be indirect, beneficial, moderate, long- term impacts. Wildland fire use fires have the potential to have long- term impacts on vegetation by either increasing or decreasing nutrient availability. These impacts would be indirect, beneficial to adverse, moderate, and long- term.

Wildland Fire Use fires may sterilize soils and/or cause them to become hydrophobic from and inhibit re- growth of vegetation. Indirect, adverse, moderate to major, short to long- term impacts.

Wildland Fire Use fires will limit mechanical soil disturbance that accompanies prescribed fire or suppression. Indirect, beneficial, moderate, long- term impacts.

Wildland Fire Use fires may negatively impact plant reproduction by the loss of seeds, acorns, and bulbs. Indirect, adverse to beneficial, negligible to major, short to long- term impacts.

Wildland Fire Use fires may trigger germination of both native and exotic fire- adapted plants. Indirect, negligible to major, adverse to beneficial, short to long- term impacts.

Cumulative

Wildland fire use mimics the natural fire regime and is second to prescribed fire (?) for returning fire to the landscape for mixed oak woodland plant communities. This impact is cumulative.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk of wildland fire ignition and high severity wildland fires offset this risk.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources will occur under Alternative IV.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires (does this assume that all Wildland Fire Use's will need suppression?). Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all known available fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives goals?. Under Alternative IV, it is expected that the number wildland fires would be reduced over time, using a combination of fire management techniques, compared to the current fire management program. The National Park Service may not impair park resources or values. An example of impairment of the mixed conifer vegetation community would include type conversion or loss of old- growth stands.

Ponderosa Pine

Impacts and issues common to all alternatives in the Ponderosa Pine Community are expected to be the same as in the Mixed Conifer Community.

Alternative I

Impacts under Alternative I for the ponderosa pine community are expected to be the same as in the Mixed Conifer Community.

Shaded Fuel Breaks

The preferred percentage of retained canopy in ponderosa pine community shaded fuel breaks has not been determined at this point. Has it been determined in the other plant communities??? Impacts may range from beneficial to adverse, negligible to major, and short to long- term. More data is needed to determine what is appropriate for this community.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large, intense wildland fires.

Short- term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions

Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources will occur under Alternative I.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires.

Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. There may be additional long- term impacts to ponderosa pine communities related to management actions proposed for this alternative, particularly related to the installation and maintenance of a shaded fuel break network, that cannot be predicted at this time. Impairment of ponderosa pine vegetation community would include loss of old- growth trees and forest characteristics, and irreversible soil damage to sensitive decomposed granite soils.

Alternative II

Please review Issues and Impacts Common to All Alternatives for this community for a review of suppression, prescribed fire and mechanical treatment level 1. Impacts under Alternative II in the Ponderosa Pine community are expected to be the same as those under Alternative 2 in the Mixed Conifer community.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources will occur under Alternative II.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires.

Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result in decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained and plant regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fire frequency and intensity would increase over time and could result in stand replacement, including loss of old- growth stands and leading to type conversion. The National Park Service may not impair park resources or values. Impairment of ponderosa pine vegetation community would include type conversion, loss of old- growth forest.

Alternative III

Please review Issues and Impacts Common to All Alternatives for a review of suppression and mechanical treatment level 1. Prescribed fire impacts discussed in that section would be the same as in this alternative, but reduced, mainly through pile burning used to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives. What follows is a discussion of impacts specific to Alternative III in the ponderosa pine community.

Mechanical Treatment Level 2

Brush mastication is added in Alternative III; using medium equipment for large scale brush removal with higher intensity and extent than Level 1 mechanical treatment. Mechanical level 2 will be limited to slopes less than 30% slope, below 3,000 feet in elevation.

Mechanical Treatment Level 2

Brush mastication is added in Alternative III; using medium equipment for large scale brush removal with higher intensity and extent than Level 1 mechanical treatment.

Large numbers of acres would be treated, resulting in individual and plant community mortality and damage to vegetation. Direct impacts would range from beneficial to adverse. Impacts would be major and long- term; vegetation may never return to pre- treatment conditions.

Mechanical treatment level 2 changes species composition and vegetation structure to a much greater extent than level 1, and would result in unnatural forest structure. These direct impacts are expected to range from beneficial from a fuels standpoint to adverse for the ecosystem, major and long- term.

Mechanical treatment level 2 would reduce fuel levels. This impact would be direct, beneficial, major, and long- term.

Impacts regarding the potential for fuel spills would be approximately the same as mechanical level 1. The exception to this comparison would be that quantities of potential fuel spills would be increased due to the fact that large brush masticators would be used that contain significantly larger quantities of fuel than chain saws and other equipment used in level 1.

Mechanical level 2 treatment has the potential to cause damage or mortality to sensitive species and non- target vegetation. These impacts would be direct, adverse, negligible to major, and short to long- term.

Mechanical level 2 treatment would result in mortality to vegetation from inadvertent damage that occurred during treatment. Impacts would be beneficial to fire program objectives, but adverse and very destructive to the vegetation community. These impacts would be indirect, major, and long- term.

Potential to increase exotics. Impacts would be the same as in other vegetation communities previously discussed in this document.

Habitat modification impacts would be the same as in other vegetation communities.

Mechanical level 2 treatment has the potential to increase pathogenic processes as a result of injury to trees during treatment. This impact would be indirect, adverse, negligible to major, short to long- term.

Reproduction rate of native plant species, including that of sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae, or if the burning of slash piles generated from treatment sterilizes the soil. These impacts would be direct and indirect, adverse, negligible to major, and short to long- term.

Level 2 treatment would decrease the likelihood of wildland fire ignition, reduce intensity of fire, and reduce risk of high severity wildland fire. These impacts would be beneficial, negligible to major, and short to long- term, depending on site specifics.

Cumulative

Mechanical level 2 treatment would result in long- term changes in vegetation composition and structure, including unknown impacts, as more studies are needed.

Level 2 treatment would eliminate or significantly reduce understory species that were adapted to the pre- treatment conditions.

Shaded Fuel Breaks

Under Alternative III, width of shaded fuel breaks would be increased from 100 to 200 feet, and shaded fuel breaks would be reviewed to determine maintenance needs on a three year cycle. Appropriate maintenance requirements would be completed as needed according to this cycle. See Shaded Fuel Break impacts discussed in Alternative I. The impacts are expected to be similar but approximately doubled in scope since width of shaded fuel breaks is doubled.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk of wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources would occur under this Alternative.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. Wildland fire intensity would be expected to increase over time. The National Park Service may not impair park resources or values. An example of impairment in the ponderosa pine vegetation community would include type conversion, loss of old- growth forest.

Alternative IV

Please review Issues and Impacts Common to All Alternatives for a review of suppression, prescribed fire and mechanical treatment level 1. Please review the discussion of mechanical treatment level 2 impacts in the previous alternative. What follows are the impacts specific to Alternative IV in the ponderosa pine community.

Mechanical Treatment Level 3

Small- scale logging is introduced in this alternative; with similar impacts expected as in mechanical levels 1 and 2, though at a higher intensity.

Small- scale logging would result in mortality and damage to vegetation, and removal of trees. This direct impact would be beneficial and adverse, negligible to major, and short to long- term, depending on methods used.

Species composition and vegetation structure would be changed to a greater extent than mechanical levels 1 and 2. This direct impact would be both beneficial to adverse, negligible to major, and short to long- term, depending on site specifics and methods used.

Small- scale logging would reduce fuel levels. This direct impact would be beneficial, moderate, and long- term.

The potential for fuel spills is increased in this alternative due to increased number of trucks and logging equipment. This impact would be direct, adverse, and negligible to major, and short to long- term.

Potential to cause damage or mortality to sensitive species. This impact would be direct, adverse, and negligible to major, short to long- term impacts.

Small- scale logging would result in mortality to vegetation from inadvertent damage that occurs during treatment. This impact would be indirect, adverse, and negligible to major, and short too long- term.

Small- scale logging may increase exotic plant populations. This impact would be indirect, adverse, and negligible to major, and short too long- term.

Habitat modification would occur as a result of alterations to composition and structure. This impact would be beneficial to fire objectives but may be adverse to the ecosystem. Impacts would be indirect, negligible to major, and short too long- term.

Increase in pathogenic processes may be expected as a result of injury to trees during treatment. This impact would be indirect, adverse, and negligible to major, with short to long- term impacts.

Reproduction of native species may be negatively affected as a result of logging equipment damage to root structures, bulbs, or mycorrhizae. These impacts would be adverse, negligible to major, and short too long- term. Reproduction of native species may be negatively affected if the burning of slash piles generated from treatment sterilizes the soil. This impact is adverse, negligible to major, and short too long- term.

Small- scale logging would decrease fire intensity, and reduce the risk of high severity wildland fire. This impact would be beneficial, negligible to major, and short too long- term.

Potential for impacts to vegetation if fuel spills occur during treatment activities. These impacts would be increased over other alternatives due to increase in number of trucks and equipment using fuel. This impact would be adverse, negligible to major, and short too long- term, depending on size of spill and other site specifics.

Cumulative

Small- scale logging treatment would result in long- term changes in vegetation composition and structure, including unknown impacts, as more studies are needed. Mechanical treatment level 3

would eliminate or significantly reduce understory species that were adapted to the pre-treatment conditions.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Shaded Fuel Breaks

Under Alternative IV, the number of shaded fuel breaks is expanded and the width is maintained along ridges at 100 feet and widened along roadsides to 200 feet. Impacts would be the same as previous sections, but over a larger area.

Wildland Fire Use

There may be some mortality and damage to vegetation during pretreatment operations. Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey and protected during burning. Plant reproduction may be negatively impacted by the loss of seeds, acorns, and bulbs. Wildland fire may trigger germination of fire-adapted plants (native and exotic). These impacts would be direct, adverse to beneficial, negligible to major, short to long-term impacts.

Wildland Fire Use results in the potential for fire to escape becoming large, severe, unmanageable fire, and the potential for damage or mortality resulting from accidental fuel spills. These impacts would be direct, negligible to major, adverse to beneficial, short to long-term impacts.

Fires would decrease nutrient availability and organic matter. Direct, negligible to major, adverse to beneficial, short to long-term impacts.

If Wildland Fire Use fires escape it would result in plant damage or mortality with direct impacts ranging from negligible to major depending on size and intensity of fire.

Exotic plant species may be introduced and spread within prescribed burn units, and exotic annual grasses can increase the probability of ignition and spread of wildland fires and have the potential to compress the fire return interval. Indirect, negligible to major, adverse, short to long-term impacts.

There may be some mortality of vegetation damaged during pre-fire and prescribed fire activities. Indirect, negligible to major, adverse, short to long-term impacts.

Potential to introduce and/or contribute to beetles and pathogens such as fungi. Indirect, negligible to major, adverse, short to long-term impacts.

Soil disturbance/compaction as a result of pretreatment activities may result in increased exotics, or decreased native plant vigor. Indirect, moderate to major, adverse, short to long-term impacts.

Potential for fire to escape, resulting in substantial mortality to overstory trees. Indirect, moderate to major, adverse, short to long-term impacts.

Thinning associated with pretreatment actions may result in increased insolation and soil temperatures, and decreased moisture. Indirect, negligible to major, beneficial to adverse, short to long-term impacts.

Thinning associated with pretreatment activities may release a seed bank of native and exotic plant species. Indirect, beneficial to adverse, negligible to major, short to long- term impacts.

Fire can stimulate fire- adapted species, and mimics natural fire in the ecosystem. These impacts are indirect, beneficial, moderate, and long- term.

Reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires. Indirect, beneficial, moderate, long- term impacts

Potential to enhance ethnobotanical uses. Indirect, beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Indirect, beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Indirect, adverse, moderate to major, short to long- term impacts.

Cumulative

Wildland fire use best mimics the natural fire regime and is second to prescribed fire for returning fire to the landscape for mixed oak woodland plant communities.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk of wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources would occur under this Alternative.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all known fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. Despite a broader range of fire management tools, it is expected that wildland fire frequency and intensity would increase over the short- term, until such time as the actions implemented on the ground begin to promote a return of the fire return interval and naturally occurring fire intensity. The National Park Service may not impair park resources or values. Impairment of ponderosa pine vegetation community would include type conversion, loss of old- growth forest.

Knobcone Pine

Issues and Impacts Common to All Alternatives in Knobcone Pine Community

Suppression

Suppression activities would result in mortality and injury of individual plants/trees as a result of construction of fire lines, heli- spots, safety zones and spike camps (ranging from use of hand tools to bulldozers). Additionally, soil disturbances would adversely impact soil mycorrhizae and other soil microorganisms that would affect long- term health of vegetation. Since most of the knobcone pine community has heavy fuel loadings and is located in the wildland urban interface where suppression activities would likely be aggressive, impacts due to suppression activities would be of higher severity in this community than in most other communities. These direct adverse impacts would be minor to major over a short duration. Alternatives emphasizing fuel reduction through prescribed fire, shaded fuel break construction and mechanical fuel reduction techniques likely would reduce the level of adverse suppression impacts, but this benefit can not be easily quantified. Where appropriate, MIST techniques will be employed to lessen impacts, but options would be limited due to the level of values at risk in this urban interface zone. Post-fire rehabilitation would assist in mitigating many effects that were severely impacting. Since the plant community is adapted to high severity disturbance events, including soil churning as a result of fire damaged windfall trees and other severe soil impacts directly or indirectly relating to high severity fire, significant long- term recovery would be expected. This would result in negligible to minor long- term adverse impacts to the Knobcone community.

Additional impacts from suppression activities would occur via the application of water, chemicals such as retardant and foam, and residual fuel from backfire burnout activities or accidental spills. These impacts are expected to be mitigated by ensuring proper training of staff, pre- planning, and application of appropriate suppression technologies. Still, some uncertainty remains pertaining to unplanned activities. If a major fuel or chemical spill did occur, extensive post incident mitigation would be employed to lessen impacts. As a result, most of the foreseeable direct and indirect effects from water, chemical and fuel spills would be adverse negligible to major short- term and negligible to moderate long- term.

One threat to the plant community exists as a result of the introduction of pathogens and exotic plant species. Fire crews and equipment may introduce or spread exotic plant species or forest pathogens through boots, vehicles, or equipment, and this effect may be exacerbated by disturbance activities related to suppression. Exotic plant species may out- compete and replace native plant species. Introduced pathogens may kill or weaken vegetation making it more susceptible to other stresses. Mitigation measures will lessen this effect to a large degree, although some uncertainty and risk will remain, particularly from the introduction of pathogens such as sudden oak death. Overall, this threat would be adverse, negligible to major, with short to long- term effects.

Successful suppression of unplanned fire events would reduce the area where fire effects occurred in the knobcone community. Since fire is a beneficial process to this community, this would result in negligible to minor short to long term impacts, with a slight potential for moderate to major cumulative impacts, although the assumption that fire suppression would continue to be successful over an extended period of time (50- 100+ years) is uncertain and not probable. Alternatives that include prescription fire as components will effectively mitigate this potential impact.

Burn- out and back- fire operations may cause mortality and damage to vegetation. It is likely that the fire effects resulting from such operations would be of a lower severity than if burning in an

uncontrolled wildland fire, thus fire severity effects would be lessened as a result of this activity. These operational tools also provide flexibility in line location and can be coordinated to take advantage of preexisting man-made or natural barriers, indirectly allowing for less disturbance than would otherwise occur as a result of line construction activities. Overall, some risk of short-term adverse negligible to moderate effects exists due to the uncontrolled and unplanned nature of wildland fire. Still, such adverse risks are not high, and the probable beneficial negligible to moderate short and long-term impacts of burn-out and back-fire operations would likely be greater than any adverse impacts.

Prescribed Fire

The use of prescribed fire to achieve fire and resource management goals is a common component of all the alternatives, although levels of treatment do vary considerably by alternative. The level of pile burning in the knobcone plant community would vary based on the level of mechanical treatments that required post-treatment of fuels by burning. Pile burns would result in localized high severity effects to soil, and could cause damage to on site and surrounding vegetation, but mitigation will limit the severity of these effects. The expected result would be a significant adverse short-term impact, but the localized nature of the treatments would contribute to only a negligible to moderate adverse effect, with negligible to minor long-term adverse impacts.

Broadcast prescribed fires in the knobcone pine community would be applied under a prescription dominated by low to moderate severity fire effects, with only small pockets experiencing high severity effects. This range of effects would support a mosaic of age classes and forest structures that would increase ecosystem diversity, and sustain fire as a process that is beneficial to the vegetation type. In general, this would result in a long-term indirect benefit to the knobcone pine community, although some increased threats may exist from exotic species that could gain dominance after burning. Mitigation measures would involve removal of many exotic species pre and post-fire, but some species, particularly small annual grasses, would be very difficult to control. These plants could out-compete native flora, but shrub and tree species would eventually dominate the site and provide a canopy cover to partially shade out these lower herbaceous species. Overall, the use of prescribed fire would result in a beneficial negligible to moderate impact to the community, although some risk would remain for an adverse short to long-term negligible to moderate impact as a result of exotic species increases.

Line construction activities that occurred in support of a prescribed fire would be very similar to those that occurred from suppression activities, except that prescribed fire activities would never include the use of dozers or similar ground scraping equipment. The prescription parameters for a prescribed fire would also be such that impacts resulting from the clearing for line construction would be less than those from suppression activities, and pre-planning would incorporate more flexibility to deal with exotic species or pathogens. The risk of escaped fire does make some of these impacts uncertain, but overall, line construction effects would be less than under a suppression scenario, with the result of a minor to moderate adverse short-term and negligible to minor adverse long-term impact to vegetation.

Levels of out of season, spring burning vary by alternative, but are generally very low. Spring burning that occurred soon after leaf out of deciduous trees and other vegetation may result in adverse impacts since most plants are more sensitive to thermal effects during this time frame. Mitigation that reduced the level of spring burning or timed spring burning to occur before leaf-out would limit these effects. Overall, however, the effects of spring burning are not well understood. Some literature purports that spring burning may be a benefit in reducing the cover of exotic grasses, although such generalizations should not be made since literature on the knobcone pine community is sparse, and site specific data that compares treatments is lacking. Overall, out of season prescribed fire impacts in this community are expected to be directly and

indirectly adverse, negligible to major in the short- term. In the long- term, impacts would range from minor beneficial to moderate adverse, although a great deal of uncertainty does exist relating to this topic.

If exotic annual grasses did increase over a short- term period following a prescribed fire, the probability of ignition and potential spread of wildland fires would increase. If a fire did establish and re- burn over a short rotational period, a compressed fire return interval could result that would alter the vegetative structure of the plant community. This scenario is not highly probable, but it does pose a threat of adverse impacts estimated to be a negligible to major over the long- term. If exotic species did proliferate, prescribed fires would not be implemented, so no cumulative impacts are anticipated.

Cumulative impacts resulting from the use of prescribed fire in the knobcone pine plant community are not certain, since other occurrences such as uncontrolled wildland fire could have additive impacts. Barring any unplanned events, it is estimated that prescribed fire would result in negligible to moderate benefits, with a potential for some negligible to moderate effects relating to exotic species. Alternatively, effective fire suppression in the absence of prescription fire or some other alternative fuel reduction method could contribute to conditions that promoted very high severity effects over a large scale. The risk of exotic species under this alternative scenario would likely be much higher than would be expected under a prescribed fire treatment regime. Given this scenario, it is expected that a range of effects from prescribed fire would occur and would include negligible to minor adverse and negligible to minor beneficial impacts.

Mechanical Treatment Level 1

The use of mechanical treatment level 1 to achieve fire and resource management goals is a common component of all the alternatives, although levels of treatment vary. In the knobcone pine community mechanical treatments will focus on the reduction of dead and live standing ladder fuels. Both shrub and tree species would be targeted, with treatments favoring rare and unique shrubs, hardwood tree species, and larger conifer trees. These treatments will result in direct mortality and damage to vegetation that could indirectly lead to mortality. In the long- term, retained vegetation would be healthier as a result of lowered competition for soil resources, although changes may result in greater damage via wind or snow events. Removed vegetation would be limited to common species, thus no individual species would be impacted beyond a negligible to moderate degree in the short- term. Over the long- term, maintenance activities would result in some changes to the vegetation structure on a very localized level, but not on a landscape or forest stand basis. These activities would, overall, result in beneficial to adverse, negligible to major, short to long- term effects.

Trampling and soil compaction would occur during treatment, resulting in adverse short- term negligible to moderate impacts, with negligible long- term impacts. Fuel spills are another potential risk, and could result in negligible to moderate short- term impacts, although mitigation should effectively eliminate this potential adverse impact.

Mechanical treatment 1 would also facilitate greater probability of fire control during suppression events, and would support greater ease in implementation of prescribed fire. These indirect effects would lead to a decrease in high impacting fire suppression control activities, and high severity fire effects. This would be a beneficial negligible to major short- term benefit, and negligible to minor long- term benefit. The mechanical treatments would also facilitate low to moderate severity fire effects by allowing greater flexibility and expanding abilities to burn in this plant community (see previous section on prescribed fire for impacts relating to prescribed fire).

Mechanical treatment level 1 may result in the introduction and/or spread of disease and pest infestations in slash piles, plus the inadvertent injury to trees during treatment. Mitigation measures will limit this threat, but it is still a negligible to minor adverse impact. Repeated maintenance of locations may result in cumulative adverse impacts, but monitoring and flexibility in repeat treatments will be established to limit these to only minor effects.

A chip layer would be applied over much of the mechanical level 1 treatment area. This chip layer will have a moderate impact on soil and plant interactions by moderating temperature and soil moisture, altering nutrient exchanges, and inhibiting germination or growth of some plant species. Overall, short- term impacts will be extremely variable, from minor adverse to minor beneficial. Some uncertainty exists pertaining to the effects from chipping, particularly in the long term, but in general, these are expected to be minor and beneficial as a result of increased growth potential of the soil.

Alternative I

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative I for the knobcone pine community.

Shaded Fuel Breaks

Shaded fuel breaks would involve the removal of vegetation, with impacts similar to mechanical Level 1, but on a larger scale. The resulting treatment would produce linear features with a forest composition and structure that is more open than would be in an unmanaged, natural forest. This would result in a change in conditions that would alter understory vegetation, with an increase cover of both native and non- native herbaceous species. Impacts would be similar to those discussed under mechanical Level 1 except that exotic plant species may be introduced or populations spread via these linear corridors. Monitoring and mitigation measures will limit this effect, but some uncertainty remains. Expected impacts are adverse, negligible to major, and short to long- terms.

Shaded fuel breaks may be used for increasing or improving recreational opportunities or on the contrary, for unintended recreation use (hiking, biking, equestrian, motorized), with a result of increased compaction and accelerated erosion on shaded fuel breaks. Monitoring and mitigation measures would be expected to limit these unintended uses to adverse, negligible to minor, short and long- term impacts. Continued maintenance would be flexible and be based on monitoring data, with the end result of a minor adverse cumulative impact to the vegetation.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. A mix of beneficial and adverse impacts would occur under this alternative. Long term adverse impacts to the community would likely occur from an increase of exotic species, but vigilant monitoring and appropriate mitigation would limit these to negligible to minor impacts, although some uncertainty remains. No impairment would be expected under this alternative.

Alternative II

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the suppression, prescribed fire, and mechanical level 1 treatment impacts. Exceptions to these impacts are that prescribed fire treatments would increase and mechanical level 1 treatments as fuel breaks would be reduced to those minimally needed to support prescribed fires.

The increase in prescribed fire will involve greater out of season, spring burning due to the limited prescription windows that exist during the dormant season and added challenges that would exist in the implementation of prescribed fire units without a pre-established shaded fuel break. As previously discussed a great deal of uncertainty remains pertaining to the application of such burning. In general, expectations are that this level of spring burning will result in minor beneficial to moderate adverse long-term impacts.

The elimination of maintained shaded fuel breaks would partially reduce the threat of expanded exotic species, but the need for control lines for implementation of prescribed fires will still retain some level of threat. This threat will pose a negligible to minor short and long-term adverse impact.

The absence of shaded fuel breaks will result in a few other adverse and beneficial impacts. Most notably, it is doubtful that the fire program could safely implement the level of burning desired, thus the ecosystem would be susceptible to large scale fire events. While adapted to high severity fire, the knobcone pine community would be susceptible to invasion by exotic species resulting in a minor to negligible long-term adverse impact. Still, without the fuel breaks as a source of exotics from which to disperse, these impacts should be less than in other scenarios.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained and plant re-growth would occur. The prescribed fire program would be expanded, and necessitate increased level of spring burning to meet resource and fire management objectives. This alternative meets several of the park's stated fire management objectives. A mix of beneficial and adverse impacts would occur under this alternative. Long term adverse impacts to the community would likely occur from an increase of spring burning, although many of these effects are poorly understood. Phasing out fuel breaks would result in a lessening of risk associated with exotic species, although eliminating fuel breaks will pose significant challenges to the implementation of prescribed fires. No impairment would be expected under this alternative.

Alternative III

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the suppression and pile burning impacts. Additional discussion of issues and impacts are included below for pile burning. The type and degree of impacts from mechanical level 1 treatment are consistent with those of Alternative I, while additional impacts relating to level 2 mechanical treatment are also discussed below.

Under this alternative prescribed fire would not occur as a landscape scale treatment. This removal of fire as an ecosystem process would result in adverse negligible to minor long-term impacts to the community assuming no wildland fires occurred. Pile burning activities would be higher in this alternative than in any others. Pile burning would include effects ranging from

minor beneficial to moderate adverse short- term and long- term impacts. Cumulative impacts to soil from pile burning would be mitigated. Cumulative impacts from effective fire suppression would probably not occur since fire risk would still be relatively high and an unplanned event would likely occur at some point in the future. Impacts from such an unplanned event are, however, too difficult to predict.

Mechanical treatment level 2 would be used in varied locations in this plant community, with a focus on reducing ladder fuel levels consisting of shrubs and small trees. Effects are poorly understood, but are expected to be wide ranging from this treatment. Mitigation should protect most uncommon or high value species, but some desired plants would be locally reduced or lost, resulting in a minor to major short- term impact and negligible to major long- term impact. In addition, damage to residual specimens would occur even with the relatively small equipment that would be employed. Some compaction and disturbance to soil would also occur. Another uncertainty is the potential risk of pathogen spreading or introducing pathogens. The response of herbaceous species is also uncertain, and probably species specific. These issues would be partially offset by an increased growth of residual desired species as a result of a reduction of competitive stresses from the treatment. Overall there is significant level of uncertainty, but these impacts are expected to range from negligible to moderate adverse short- term impacts and from minor beneficial to minor adverse long- term impacts.

Under Alternative III, width of shaded fuel breaks would be increased from 100 (current program) to 200 feet. This treatment would expand beneficial and adverse impacts discussed under the shaded fuel break section for alternative I.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. Many uncertainties exist in relation to this alternative, with the potential for numerous adverse impacts including an increase in exotic species, a decrease in sensitive or high value species, and an increase in forest pathogens. The chipped materials may eventually increase soil growth potential, but this benefit is uncertain. No impairment is anticipated under this alternative.

Alternative IV

Please review the Development of Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. Please review Alternative III for a discussion of mechanical level 2 treatment impacts. Additional comments on these treatments are included in the following discussion. This alternative also includes the mechanical level 3 (small- scale logging) and wildland fire use as fire management actions.

Mechanical level 1 and 2 impacts would

Mechanical Treatment Level 3 impacts would include impacts to soil and residual forest vegetation, in addition to impacts be of higher intensity than mechanical level 1, but less than mechanical level two2. Impacts would be the same or very similar to mixed conifer and ponderosa pine communities.

Direct

Small- scale logging would result in mortality and damage to vegetation, and removal of trees. This impact would be both beneficial and adverse, negligible to major, and short to long- term, depending on site specifics, and methods used.

Species composition and vegetation structure would be changed to a greater extent than Level 1 and Level 2. This impact would be both beneficial to adverse, negligible to major, and short to long- term, depending on site specifics and methods used.

Small- scale logging would reduce fuel levels. This impact would be beneficial, moderate, and long- term.

Potential for fuel spills. Same as discussed in earlier sections on the impacts of mechanical treatment, but somewhat increased due to increased number of trucks and logging equipment. Adverse, negligible to major, short to long- term effects.

Potential to cause damage or mortality to sensitive species. Impacts would be adverse, negligible to major, short to long- term effects.

Indirect

Small- scale logging would result in mortality to vegetation from inadvertent damage that occurs during treatment. This impact would be adverse, negligible to major, and short to long- term.

Small- scale logging may increase exotic plant populations. This impact would be adverse, negligible to major, and short to long- term.

Habitat modification would occur as a result of alterations to composition and structure. This impact would be beneficial to fire objectives but may be adverse to the ecosystem. Impacts would be negligible to major, and short to long- term, depending on site specifics.

Increase in pathogenic processes may be expected as a result of injury to trees during treatment. This impact would be adverse, negligible to major, with short to long- term effects, depending on site specifics.

Reproduction of native species may be negatively affected as a result of logging equipment damage to root structures, bulbs, or mycorrhizae. These impacts would be adverse, negligible to major, and short to long- term, depending on degree of damage and other site specifics. Reproduction of native species may be negatively affected if the burning of slash piles generated from treatment sterilizes the soil. This impact is adverse, negligible to major, and short to long- term.

Small- scale logging would decrease fire intensity, and reduce the risk of high severity wildland fire. This impact would be beneficial, negligible to major, and short to long- term.

Potential for impacts to vegetation if fuel spills occur during treatment activities. Same as... but increased due to increase in number of trucks and equipment using fuel. This impact would be adverse, negligible to major, and short to long- term, depending on size of spill and other site specifics.

Cumulative

Small- scale logging treatment would result in long- term changes in vegetation composition and structure, including unknown impacts as more studies are needed.

Level 3 treatment would eliminate or significantly reduce understory species that were adapted to the pre- treatment conditions.

These impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Shaded Fuel Breaks

Under Alternative IV, the number of shaded fuel breaks is expanded from the current program, and the width of shaded fuel breaks is 200 feet along roads and remains at 100 feet along ridges.

Direct

Mortality and damage to vegetation would occur on a larger scale than mechanical treatment used to recreate more natural forest conditions (decreased percent cover). Beneficial to adverse, negligible to major, short to long- term effects.

Changes species composition and vegetation structure would occur that are not designed to mimic natural forest conditions. May have both beneficial and adverse impacts, negligible to major, short to long- term effects.

The percent of retained canopy in knobcone pine is not determined at this time. More data is needed.

Fuel levels would be reduced. Beneficial, negligible to major, short to long- term effects. Potential fuel spills may cause damage to vegetation. Adverse, negligible to major, short to long- term effects.

Damage or mortality to sensitive species may occur. Possibly beneficial (if species respond favorably to disturbance) to adverse, negligible to major, short to long- term effects.

Indirect

Vegetation may exhibit mortality from damage that occurred during treatment. Beneficial to adverse, negligible to major, short to long- term effects.

Habitat fragmentation effects would be magnified as a result of 200- foot wide swaths of altered vegetation along roadside fuel breaks. Adverse, negligible to major, short to long- term effects.

Greater potential for introduction or expansion of exotic plant species due to increased width of shaded fuel breaks. Adverse, negligible to major, short to long- term effects.

Increased pathogenic processes as a result of injury to trees during treatment may occur. Beneficial to adverse, negligible to major, short to long- term effects.

Vegetation reproduction may be affected if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. Beneficial to adverse, negligible to major, short to long- term effects.

Treatment would decrease likelihood of wildland fire ignition, reduce intensity of fire, reduce risk of high severity wildland fire, provides access and escape route for fire crews. Beneficial, negligible to major, short to long- term effects.

Treatment may impact vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term.

Treatment may increase impacts to knobcone pine community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term effects.

Cumulative

Long- term changes in composition and structure would occur.

Understory species, and those that were adapted to the pre- treatment conditions would be significantly reduced or eliminated.

There may be long- term effects that are unknown at this time.

Wildland Fire Use

Although wildland fire use is a component of Alternative IV, the knobcone pine community does not occur in the areas where wildland fire use would be contemplated.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of knobcone pine vegetation community would include type conversion.

Mixed Oak Woodland

Issues and Impacts Common to All Alternatives in the mixed oak woodland community.

Suppression

Direct

There may be some mortality of individual plants/trees related to construction of fire lines, heli-spots, safety zones, and spike camps (ranging from use of hand tools to bulldozers). Adverse, negligible to moderate, short- term to long- term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity.

Felling of large trees to facilitate fire suppression activities. Range of beneficial to adverse, moderate to major, short- term to long- term impacts depending on site specifics.

Damage to vegetation from fire crews, engines, and fire line construction activity. Beneficial to adverse, negligible to major, short- term impacts depending on site specifics.

There may be some mortality or damage to vegetation from aircraft water drops and high- pressure hoses used to suppress fire. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Fuel accidentally spilled during fire suppression activities may kill vegetation. Adverse, negligible to major, short to long- term impacts depending on size and location of spill.

There may be some mortality and damage to vegetation from management- ignited fires (burn- outs/back- burns). Beneficial to adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Potential impacts to vegetation from retardants (state what retardants are used, ingredients, and impacts). Adverse, negligible to moderate, short- term impacts, depending on site specifics.

Threatened and endangered species experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, or, if known, not taken into consideration during initial attack/suppression activities. Beneficial or adverse, minor to major, short to long- term impacts depending on species, activity, level of intensity.

Mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Indirect

The potential for a large, severe, and unmanageable wildland fire is reduced, and the consequential adverse fire impacts. Beneficial and adverse, moderate to major, long- term impacts.

There may be some mortality occurring after fire suppression resulting from damage during suppression activities. Beneficial to adverse, moderate to major, short to long- term impacts, depending on site specifics.

Retardant containing fertilizers may increase exotic species. Adverse, negligible to major, short to long- term impacts, depending on species and site specifics.

Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out- compete and replace native plant species. Adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species. Adverse, moderate to major, short to long- term impacts.

Potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. More data needed.

Potential to contribute to bark beetle, fungal infestations or other pathological processes as a result of injury to trees resulting from suppression activities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Habitat would be altered in areas where firelines, spike camps, safety zones, and heli- spots were constructed. Alterations include species composition, structure and function. Beneficial to adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, and degree of compaction.

Potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill.

Mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Sensitive, threatened and endangered species and large overstory trees are protected where fire is suppressed; fire- adapted sensitive species may not do well if fire is suppressed. Beneficial to adverse, negligible to major, short to long- term.

The potential for type- conversion related to a high severity wildland fire would not occur if suppression activities are successful. Beneficial, major, long- term.

Damage to vegetation/ soil organisms may occur as a result of incomplete combustion of fuels used to conduct burnouts. Adverse, minor to moderate, short- term.

Cumulative

Fire suppression would alter the composition, structure, and function of this plant community; this impact can be additive in regards to historical land abuse and management actions, including logging, mining, development, road building, dam construction, recreational use, watershed restoration, and ironically, fire suppression.

Fire adapted species would decrease over time as a result of fire suppression, since the natural fire cycle interrupted. Long- term fire suppression has increased fuel levels and fire hazard in this vegetation community.

Prescribed Fire

Direct

There may be some mortality and damage to vegetation during pre- fire thinning and construction of prescribed fire burn unit boundaries. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be some mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire would trigger germination of fire- adapted plants – seasonality depending. Negligible to major, adverse to beneficial, short to long- term impacts.

Potential for prescribed fire to escape, possibly becoming a large and severe wildland fire. Moderate to major, adverse to beneficial, short to long- term impacts.

Potential for damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Loss of canopy cover can lead to exotic annual grasses, which in turn can increase the probability of ignition and spread of wildland fires and potentially compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees.

Burn piles can also sterilize the soil in localized spots, which enables wind- dispersed and weedy species the upper hand in colonization, resulting in patches of infestations.

Potential to introduce and/or spread pathogens such as beetles and fungi. Negligible to major, adverse, short to long- term impacts.

Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor. Negligible to major, adverse, short to long- term impacts.

Potential for prescribed fire to escape, resulting in substantial mortality to mixed oak woodland plant community. Moderate to major, adverse, short to long- term impacts.

Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long- term impacts.

Prescribed fire can reduce overstocked and suppressed understory brush and trees, while favoring large overstory species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Fire adapted species benefit from prescribed fire. Beneficial, moderate, long- term happy impacts.

Reduces the potential for large and intense wildland fires. Beneficial, moderate, long- term impacts

Reduces the intensity of subsequent wildland fires. . Beneficial, moderate, long- term impacts

There is the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

Potential for fuel spill to damage vegetation not consumed during prescribed burn activities. Adverse, negligible to major, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from minor to major depending on size and intensity of fire.

Cumulative

Prescribed fire is expected to mimic a more natural fire regime in mixed oak woodlands. Beneficial, long- term, moderate to major impacts.

Reduced potential for crown fire and extreme fire behavior, reduced fire intensity at landscape scale. Beneficial, long- term, moderate to major happy impacts.

Mechanical Treatment Level 1

Direct

There may be some mortality and damage to vegetation. Beneficial to adverse, negligible to major, short to long- term impacts.

Changes species composition and vegetation structure. Beneficial and adverse impacts, negligible to major, short to long- term impacts.

Reduction in ladder fuels and fuel loads are redistributed, thus decreasing fire intensity if the surface fuels are treated. Beneficial, moderate, short to long- term impacts.

Potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

Potential to cause damage or mortality to sensitive and overstory tree species. Adverse, negligible to major, short to long- term impacts.

Potential for slash piles to damage/kill overstory tree species. Adverse, negligible to moderate, short to long- term impacts.

Indirect

There may be some mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

Habitat modification as a result of alterations to composition and structure. Adverse to beneficial, negligible to major, short to long- term impacts.

Increase in the introduction and/or spread of disease and infestation due to slash piles and inadvertent injuries to trees during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

Reproduction may be slowed if chip layer is too thick. Adverse to beneficial, negligible to major, short to long- term impacts.

Reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil. Adverse to beneficial, negligible to major, short to long- term impacts.

Slash piles can also lead to infestations of wind- dispersed exotic plant species. Adverse, negligible to major, short to long- term impacts.

Increased likelihood of wildland fire ignition (reduced canopy from thinning can make conditions favorable to annual grasses – which can make ignition and spread of fire much more likely, plus conditions near the ground surface are warmer and wind can dry fuels out quicker), reduced intensity of fire, reduced risk of crown fire. Adverse to beneficial, negligible to major, short to long- term impacts.

Potential to damage vegetation if fuel spills occur during treatment activities. Adverse to beneficial, negligible to major, short to long- term impacts.

Cumulative

Reduction of fuels decreases the probability of crown fire.

Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species.

Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative I in the mixed oak woodland community.

Prescribed Fire

Cumulative

It should be noted that prescribed fire alone cannot fully mimic the ecosystem functions of pre-settlement fire because the forests have changed greatly and the impacts of reintroduced fire are likely to be different than those of pre- settlement fire. If fire alone is used, several applications of prescribed fire would be necessary, especially in densely stocked stands with heavy fuel concentration. Thinning before prescribed fire can decrease the probability of large intense fires. Beneficial, moderate to major, long- term impacts.

Shaded Fuel Breaks

Direct

Increased mortality and damage to vegetation resulting from maximizing fuel reduction rather than mimicking a more natural oak woodland composition and structure. May have adverse and beneficial, negligible to major, short to long- term impacts.

Fuel levels are reduced. Beneficial, negligible to major, short to long- term impacts.

Crown fire spread would be minimized. Beneficial, negligible to major, short to long- term impacts.

There is an increased potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There is a potential to cause damage or mortality to sensitive species. Adverse, negligible to major, short to long- term impacts.

Indirect

Incidental mortality may occur from damage that happens during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

Some habitats will be fragmented as a result of 100- foot wide swaths of altered vegetation. Adverse, negligible to major, short to long- term impacts.

There will be landscape heterogeneity – including edge effects for some species. Beneficial, negligible to moderate, short to long- term impacts.

There is the potential for introduction or expansion of exotic plant species. Adverse, negligible to major, short to long- term impacts.

There is increased potential to introduce and spread diseases and infestations. Adverse, negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if chip layer is too thick. May have adverse to beneficial, negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil. May have adverse to beneficial, negligible to major, short to long- term.

Annual grasses can increase the potential of ignition and spread of wildland fires, while at the same time fire intensity is reduced, and there is a reduced risk of large and intense fires. Adverse to beneficial, moderate, short to long- term impacts.

There is the potential for impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term impacts.

There is the potential for increased recreation use (hiking, biking, and equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term impacts.

Cumulative

Long- term changes in vegetation composition, structure and function.

Repeated treatments in this habitat type would be repeatedly increasing the chance to introduce and spread exotic plant species, disease, and infestations.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense wildland fires. Short- term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions. Prescribed fires may escape to become wildland fires; this risk is offset by the removing ladder fuels and redistributing fuel loads to reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and intensity. There may be additional long- term impacts to mixed oak woodlands that are related to management actions proposed for this alternative, (particularly related to the installation and maintenance of a shaded fuel break network) that cannot be predicted at this time. The National Park Service may not impair park resources or values. Impairment of mixed conifer vegetation community would include type conversion and loss of alteration of soils.

Alternative II

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts

Impacts Specific to Alternative II in Mixed Oak Woodland Community

Prescribed Fire

The following impacts are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire. Additionally, reliance on prescribed fire to treat the number of acres anticipated would undoubtedly require some amount of spring burning.

Direct

Spring burning can result in the direct mortality of overstory trees. Adverse, negligible to major, short to long- term.

Indirect

Spring burning can result in loss of overstory trees and herbaceous species. Adverse, negligible to major, short to long- term impacts.

Cumulative

Potential for undesirable alteration of habitat due to plant loss resulting from spring burning.

Mechanical treatment level 1 would occur mainly in prescribed fire burn unit boundaries.

Shaded Fuel Breaks

Indirect

Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrowth. Beneficial to adverse, negligible to major, short to long- term impacts.

Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers. Adverse, negligible to major, short to long- term impacts.

There would be less of a chance to control the fire size. Adverse, negligible to major, short to long- term impacts.

Cumulative

No long- term changes in composition and structure, hopefully moving towards a more natural, pre- suppression condition. Continuous distribution of high fuel loadings across the landscape would reduce the potential to control the fire size. There is no potential for habitat fragmentation resulting from the construction of linear features (burn- unit boundaries).

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires.

Short- term impacts related to project activity would restore more natural forest conditions

Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This would also increase overstory mortality of desired large trees.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and intensity. The National Park Service may not impair park resources or values. Impairment of mixed oak woodland community would include type conversion and loss of soil horizons.

Alternative III

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative III in the mixed oak woodland plant community.

Prescribed Fire

Impacts discussed at the beginning of this vegetation community would be reduced; mainly because of pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 1

Cumulative

Short- term changes in composition and structure, hopefully moving towards a more natural, pre- suppression condition. There is the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions.

Mechanical Treatment Level 2

Brush mastication is added in Alternative III; using medium- sized equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment.

Direct

There may be some mortality and damage to vegetation. Beneficial to adverse, negligible to major, short to long- term impacts.

Changes in species composition and vegetation structure to a greater extent than Level 1. Beneficial to adverse, negligible to major, short to long- term impacts.

Hazardous fuel levels would be reduced. Beneficial, negligible to major, short to long- term impacts.

There is the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There is the potential to cause damage or mortality to sensitive species and non- target vegetation. Adverse, negligible to major, short to long- term impacts.

There is the potential to damage or destroy sensitive or uncommon species. Beneficial, negligible to major, short to long- term impacts.

Indirect

There may be inadvertent mortality from damage that occurred during treatment. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be increased potential to introduce and spread exotic plant species. Adverse, negligible to major, short to long- term impacts.

There may be some habitat modification as a result of alterations to understory composition and structure. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be increased introduction and spread of disease and infestation as a result of injury to trees during treatment. Adverse, negligible to major, short to long- term impacts.

Vegetation reproduction, including sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae. Adverse, negligible to major, short to long- term impacts.

Reduced canopy cover and increased disturbance can lead to an increased likelihood of wildland fire ignition and spread, and consequently compressed fire regimes. Adverse, negligible to major, short to long- term.

There may be reduced risk of crown fire and extreme fire behavior or large and unmanageable fires. Beneficial, negligible to major, short to long- term impacts.

Potential for impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term impacts.

Cumulative

Long- term changes in composition and structure, including unknown.

There may be the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions.

Fire management actions (all mechanical treatment levels and prescribed fire – basically repeated disturbance of any kind) would greatly enhance exotic plant infestations.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would have a direct effect on the vegetation.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of mixed oak woodland community would include type- conversion and loss of soil horizon.

Alternative IV

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. Please review the impacts of mechanical level 2 treatment in Alternative III above. Small- scale logging is not considered for the mixed oak woodland vegetation community. What follows is a review of the impacts specific to Alternative IV in the mixed oak woodland community.

Shaded Fuel Breaks

Under Alternative IV, the number of shaded fuel breaks is expanded from the present, and the width is doubled from the current 100 feet to 200 feet along roads, and remains 100 feet along ridges.

Direct

There may be some mortality and damage to understory vegetation on a larger scale. Adverse, negligible to major, short to long- term impacts.

Changes in species composition and vegetation structure. Beneficial to adverse impacts, negligible to major, short to long- term impacts.

Fuel levels and ladder fuels are reduced. Beneficial, negligible to major, short to long- term impacts.

Increased potential to cause damage or mortality to sensitive species and overstory tree species. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be inadvertent mortality from damage that occurred during treatment. Adverse, negligible to major, short to long- term impacts.

There may be the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be increased potential for habitat fragmentation impacts as a result of 200- foot wide swaths of altered vegetation. Adverse, negligible to major, short to long- term impacts.

There may be greater potential for introduction or expansion of exotic plant species. Adverse, negligible to major, short to long- term impacts.

There may be increased probability to introduce and pathogens as a result of inadvertent injury to trees during treatment. Adverse, negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if chip layer is too thick. Beneficial to adverse, negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and/or damages overstory canopy trees. This can also lead to localized infestations of wind- dispersed weedy species. Adverse, negligible to major, short to long- term impacts.

There may be increased potential for ignition, reduced fire intensity, reduced risk of large and intense fires, provides access and escape routes for fire crews. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be potential for impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term.

There may be increased potential to introduce and spread pathogens – especially if slash piles are not burned and or chipped immediately.

There may be potential for increased impacts to mixed oak woodland plant community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term impacts.

Cumulative

There may be potential to introduce and spread exotic plant species. There may be long- term impacts that are unknown at this time. More data is needed.

Wildland Fire

Direct

There may be some mortality and damage to vegetation during pretreatment operations. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be some mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction may be negatively impacted by the loss of seeds, acorns, and bulbs. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire may trigger germination of fire- adapted plants (native and exotic). Negligible to major, adverse to beneficial, short to long- term impacts.

There may be potential for fire to escape, possibly a large, severe and unmanageable fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be potential for damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially may compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

There may be potential to introduce and/or spread contribute to beetles and pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

Soil disturbance/compaction as a result of pretreatment activities may result in increased exotics, or decreased native plant vigor. Moderate to major, adverse, short to long- term impacts.

Potential for fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long- term impacts.

Thinning associated with pretreatment actions may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long-term impacts.

Thinning associated with pretreatment activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long- term impacts.

Fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Prescribed fire reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires. Beneficial, moderate, long- term impacts

There may be the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Wildland fire use best mimics the natural fire regime and is second to prescribed fire for returning fire to the landscape for mixed oak woodland plant communities.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk (potential for ignition is increased) of crown fire and large and unmanageable wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park

resources or values. Impairment of mixed oak woodland vegetation community would include loss of soil horizons and type conversion.

Blue Oak Grassland

Issues and Impacts Common to All Alternatives in the blue oak grassland community

Suppression

Direct

There may be some mortality of individual plants/trees and shrubs related to construction of fire lines, heli- spots, safety zones, and spike camps (ranging from use of hand tools, engines, to bulldozers). Range of beneficial or adverse short- term to long- term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity.

Some removal of shrubs and overstory trees may occur to facilitate fire suppression activities. Range of beneficial to adverse, moderate to major, short- term to long- term impacts depending on site specifics.

There may be damage to vegetation from fire crews and fire line construction activity. Beneficial to adverse, negligible to major, short- term impacts depending on site specifics.

There may be some mortality or damage to vegetation from aircraft water drops and high- pressure hoses used to suppress fire. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

There may be fuel accidentally spilled during fire suppression activities may kill vegetation. Adverse, negligible to major, short to long- term impacts depending on size and location of spill.

There may be mortality and damage to vegetation from management- ignited fires (burn- outs/back- burns). Beneficial to adverse, negligible to moderate, short to long- term impacts depending on site specifics.

There may be some potential impacts to vegetation from retardants (state what retardants are used, ingredients, and impacts). Beneficial to adverse, negligible to moderate, short- term impacts, depending on site specifics.

Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, or, if known, not taken into consideration during initial attack/suppression activities. Beneficial or adverse, minor to major, short to long- term impacts depending on species, activity, level of intensity.

There may be mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Indirect

There may be mortality occurring after fire suppression resulting from damage during suppression activities. Beneficial to adverse, moderate to major, short to long- term impacts, depending on site specifics.

Retardant containing fertilizers may increase exotic species. Adverse, negligible to major, short to long- term impacts, depending on species and site specifics.

Fire crews and equipment may introduce or would most likely continue the spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out- compete and replace native plant species. Adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species. Adverse, moderate to major, short to long- term impacts.

There may be some potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. More data is needed.

There may be the potential to contribute to fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Some habitat may be altered in areas where firelines, spike camps, safety zones, and heli- spots were constructed. Alterations include changes in species composition, structure and function. Beneficial to adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor and if significant, this can negatively affect the roots of old oaks. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, and degree of compaction.

There may be the potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill.

There may be some mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Sensitive and threatened and endangered species are protected where fire is suppressed; fire- adapted sensitive species may not do well if fire is suppressed. Beneficial to adverse, negligible to major, short to long- term. More data is needed.

Fire- dependent species and blue oak acorns are denied the beneficial impacts of fire during suppression activities. Adverse, negligible to major short to long- term.

Cumulative

Fire- adapted plant species in the blue oak woodlands are denied the beneficial impacts of fire. Fire suppression would lead to further shrub and pine encroachment, which could potentially create a fire severe enough to kill large blue oaks.

Prescribed Fire

Direct

There may be mortality and damage to vegetation during pre- fire thinning and construction of prescribed fire burn unit boundaries. Adverse to beneficial, negligible to major, short to long-term impacts.

There may be mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire would trigger germination of acorns and fire- adapted plants – seasonality depending. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential for prescribed fire to escape, possibly to a large, severe and unmanageable fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential for damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential for fuel spill to damage vegetation not consumed during prescribed burn activities. Adverse, negligible to major, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic annual grasses are now pretty much a part of this plant community, though more exotic plant species would be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Management ignited fires in the spring can potentially help control the extensive star thistle infestations in this plant community. However, overstory blue oaks and acorns would be negatively affected. Adverse to beneficial, negligible to major, short to long- term.

Management ignited fires in the fall may further spread star thistle in this plant community, at the same time facilitating the germination of seedlings. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees. Burn piles can also sterilize the soil in localized spots, which enables wind- dispersed and weedy species the upper hand in

colonization, creating patches of infestations. Adverse, negligible to major, short to long- term impacts.

There may be the potential to introduce and/or spread pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor. Negligible to major, adverse, short to long- term impacts. Negligible to major, adverse, short to long- term impacts.

Prescribed fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

There may be the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Prescribed fire is expected to re- create a more natural fire regime in the blue oak woodlands.

Prescribed fire is expected to stimulate diversity in both native and non- native plant species. Blue oaks and star thistle would both benefit from fall burns, and both be reduced for spring burns.

Prescribed fire would reduce the density of understory shrubs that may be encroaching into this area.

Mechanical Treatment Level 1

Direct

There may be mortality and damage to vegetation. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be changes species composition and vegetation structure. Beneficial and adverse impacts (could increase exotics, could also provide more diverse habitat for a range of native species, negligible to major, short to long- term impacts.

Fuel levels are reduced. Beneficial, moderate, short to long- term impacts.

There is the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be potential to cause damage or mortality to sensitive and overstory tree species. Adverse, negligible to major, short to long- term impacts.

There may be potential for slash piles to damage/kill overstory tree species. Adverse, negligible to moderate, short to long- term impacts.

There may be potential to adversely impact sensitive or uncommon plants. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be increases in the introduction and/or spread of disease and infestations due to slash piles and inadvertent injuries to individual plants during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

Vegetation reproduction may be slowed if chip layer is too thick. Adverse to beneficial, negligible to major, short to long- term impacts.

Vegetation reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil. Adverse to beneficial, negligible to major, short to long- term impacts.

Slash piles and soil disturbance can also lead to infestations of wind- dispersed exotic plant species. Adverse, negligible, short to long- term.

There may be potential to damage vegetation if fuel spills occur during treatment activities. Adverse to beneficial, negligible to major, short to long- term impacts.

Thinning of understory species can mimic natural structural patterns. Beneficial, negligible to minor, short- term impacts.

Cumulative

Reduction and rearrangement of fuels increases the chances of managing wildland fires effectively.

Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species.

Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a description of the impacts specific to Alternative I for the blue oak woodlands community.

Shaded Fuel Breaks

Direct

Direct mortality and damage to vegetation May have adverse and beneficial, negligible to major, short to long- term impacts.

Changes species composition and vegetation structure not designed to mimic natural oak woodland conditions. May have both beneficial and adverse impacts, negligible to major, short to long- term.

Fuel levels are reduced or rearranged. Beneficial, negligible to major, short to long- term impacts.

There may be the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be potential to cause damage or mortality to sensitive species. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be habitat fragmentation as a result of 100- foot wide swaths of altered vegetation. Adverse, negligible to major, short to long- term impacts.

There may be potential for introduction and further spread of exotic plant species. Current populations would definitely benefit from disturbance. Adverse, negligible to major, short to long- term impacts.

There may be increase potential to introduce and spread disease and infestations. Adverse , negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if chip layer is too thick. May have adverse to beneficial, negligible to major, short to long- term impacts.

Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil. May have adverse to beneficial, negligible to major, short to long- term.

The potential of ignition and spread of wildland fires (e.g., lack of canopy cover and disturbance promotes annual grasses) may reduce intensity of fire, and reduce risk of large and intense fires . Adverse to beneficial, moderate, short to long- term impacts.

There may be the potential for impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term impacts.

There may be potential for increased recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term impacts.

Cumulative

Exotics would be exacerbated. Repeated treatments in this habitat type would be repeatedly increasing the chance to introduce and spread exotic plant species, disease, and infestations.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removing ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values.

There may be additional long- term impacts to blue oak woodland communities related to management actions proposed for this alternative, particularly related to the installation and maintenance of a shaded fuel break network that cannot be predicted at this time. Impairment of the blue oak woodland community would include loss of soils and type conversion.

Alternative II

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative II in the blue oak woodland community.

Prescribed Fire

Prescribed fire impacts are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire.

Shaded Fuel Breaks

Indirect

Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrowth. Beneficial to adverse, negligible to major, short to long- term impacts.

Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers. Adverse, negligible to major, short to long- term impacts.

There would be less of a chance to control the fire size. Adverse, negligible to major, short to long- term impacts.

Cumulative

No potential to eliminate or significantly reduce understory species, or those adapted to the pre-treatment conditions.

No potential for habitat fragmentation resulting from the construction of linear features (burn-unit boundaries).

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short- term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This would have a adverse effect on the overstory blue oaks, seedlings and acorns, but a positive effect on the start thistle that makes up a major portion of the blue oak woodlands.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of blue oak woodland would include type conversion and loss of soil horizons.

Alternative III

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative III in the blue oak woodland community.

Prescribed Fire

Prescribed fire would be reduced; mainly through pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 1

Cumulative

Short- term changes in composition and structure.

Potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions.

Mechanical Treatment Level 2

Brush mastication is a component of Alternative III; using medium to equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment. Brush masticate would not occur in the blue oak woodlands.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce make large and intense fires more manageable. Burn piles may escape to become wildland fires – greater chance of exotics and increased probability of ignition and spread.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction with direct effect on the vegetation is likely to occur.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. However, mechanical or repeated disturbance of this community could really be harmful to this plant community in terms of seedling regeneration and the spread of exotic plant species. We need prescribed fire for this community. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the blue oak woodlands would include type conversion or loss or hydrophobicity of soils and lack of seedling regeneration.

Alternative IV

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. Alternative IV adds mechanical level 3 (small- scale logging) to mechanical levels 1 and 2. However, there would be no brush mastication or small- scale logging in the blue oak woodlands. Doing so would seriously impact seedling regeneration of oaks would make conditions absolutely fabulous for all the exotics. Soil compaction could damage overstory trees too. What follows is a discussion of the impacts specific to Alternative IV to the blue oak woodlands.

Shaded Fuel Breaks

Under Alternative IV, the number of shaded fuel breaks is expanded from the current strategy, and shaded fuel break width is doubled to 200 feet along roads. Ridge shaded fuel breaks would remain at 100 feet. The blue oak woodland forest structure already mimics that of a shaded fuel break. Shrubs that encroach over time can be removed along designated ridgelines. But overall, shaded fuel break construction would not occur in the same manner and scale as in other vegetation communities.

Wildland Fire Use

Wildland fire use is a component of Alternative IV, however the blue oak woodland community is outside the area in which wildland fire use would be considered.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of blue oak woodland plant community would include loss of large overstory blue oaks, loss of seedling regeneration in this plant community, and loss of soils or hydrophobicity of soils.

Chaparral

Issues and Impacts Common to All Alternatives in the chaparral community

Suppression

Direct

There may be some mortality of individual plants/trees and shrubs related to construction of fire lines, heli- spots, safety zones, and spike camps (ranging from use of hand tools to bulldozers). Range of beneficial or adverse short to long- term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity.

There may be removal of shrubs and overstory trees (e.g., knob cones and black oaks) to facilitate fire suppression activities. Range of beneficial to adverse, moderate to major, short- term to long- term impacts depending on site specifics.

There may be damage to vegetation from fire crews, engines, and fire line construction activity. Beneficial to adverse, negligible to major, short- term impacts depending on site specifics.

There may be mortality or damage to vegetation from aircraft water drops and high- pressure hoses used to suppress fire. Beneficial to adverse, negligible to moderate, short to long- term impacts depending on site- specifics.

There may be fuel accidentally spilled during fire suppression activities may kill vegetation. Adverse, negligible to major, short to long- term impacts depending on size and location of spill.

There may be mortality and damage to vegetation from management- ignited fires (burn-outs/back- burns). Beneficial to adverse, negligible to moderate, short to long- term impacts depending on site specifics.

There may be some potential impacts to vegetation from retardants. Adverse, negligible to moderate, short- term impacts, depending on site specifics.

Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, or, if known, not taken into consideration during initial attack/suppression activities. Beneficial or adverse, minor to major, short to long- term impacts depending on species, activity, level of intensity.

There may be some mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Chaparral plant community may be denied the numerous beneficial impacts of fire – adverse, moderate to major, long- term impacts.

Indirect

There may be mortality occurring after fire suppression resulting from damage during suppression activities. Beneficial to adverse, moderate to major, short to long- term impacts, depending on site specifics.

Retardant containing fertilizers may increase exotic species. Adverse, negligible to major, short to long- term impacts, depending on species and site specifics.

Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out-compete and replace native plant species. Adverse, negligible to major, short to long-term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species, and could compress the fire regime. Adverse, moderate to major, short to long-term impacts.

There may be potential impacts relating to use of retardants that affect individual plant health and plant community composition, including aquatic communities. Adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics. (More data needed)

There may be potential to contribute to fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities. Adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics.

Some habitat would be altered in areas where firelines, spike camps, safety zones, and heli-spots were constructed. Alterations include species composition, structure and function. Beneficial to adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics.

Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor. Adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics, and degree of compaction.

There may be potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed. Adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics, size and extent of spill.

Mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration. Adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics.

Sensitive and threatened and endangered species and large overstory trees are protected where fire is suppressed; fire-adapted sensitive species may not do well if fire is suppressed. Beneficial to adverse, negligible to major, short to long-term. More data needed.

The potential for type-conversion related to a high severity wildland fire is avoided if suppression activities are successful. Beneficial, major, long-term.

Some fire-dependent chaparral plant species are denied the beneficial impacts of fire during suppression activities. Adverse, negligible to major short to long-term.

Cumulative

Some fire-adapted plant species in the chaparral plant community are denied the beneficial impacts of fire.

The chaparral vegetation community fire regime ranges from 30- 120 years, so Whiskeytown's fire history is well within the normal range of variation. Although commonly described as "stand decadence" chaparral plant community accumulation of fuels reaches a maximum at about 15

years. Beyond that time period, individual plants don't get much bigger or denser. Therefore, there really aren't very many cumulative impacts of fire suppression.

Prescribed Fire

Direct

There may be mortality and damage to vegetation during thinning and construction of prescribed fire burn unit boundaries. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire would trigger germination of fire- adapted plants – seasonality depending. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be potential for prescribed fire to escape, possibly a large, severe and unmanageable fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be potential for damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential for fuel spill to damage vegetation not consumed during prescribed burn activities. Adverse, negligible to major, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

Management ignited fires in the spring can result in a type conversion to chemise. This can increase the probability of ignitions and rates of spread. Adverse, major, long- term.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees. Burn piles can also sterilize the soil in localized spots, which enables wind- dispersed and weedy species the upper hand in

colonization, resulting in patches of infestations. Adverse, negligible to major, short to long- term impacts.

There may be the potential to introduce and/or spread pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor. Negligible to major, adverse, short to long- term impacts. Negligible to major, adverse, short to long- term impacts.

There may be the potential for prescribed fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long- term impacts.

Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long- term impacts.

Thinning associated with prescribed fire activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long- term impacts.

Prescribed fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Prescribed fire reduces the potential for large and intense wildland fires. Beneficial, moderate, long- term impacts

Prescribed fire reduces the intensity of subsequent wildland fires. . Beneficial, moderate, long-term impacts

There may be the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Prescribed fire is expected to stimulate diversity in both native and non- native plant species. It is also expected to break- up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires.

Mechanical Treatment Level 1

Direct

There may be some mortality and damage to vegetation. Beneficial to adverse, negligible to major, short to long- term impacts.

Prescribed fire changes species composition and vegetation structure. Beneficial and adverse impacts (could increase exotics, could also provide more diverse habitat for a range of native species, negligible to major, short to long- term impacts.

Fuel levels are reduced. Beneficial, moderate, short to long- term impacts.

There may be the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be the potential to cause damage or mortality to sensitive and overstory tree species. Adverse, negligible to major, short to long- term impacts.

There may be the potential for slash piles to damage/kill overstory tree species. Adverse, negligible to moderate, short to long- term impacts.

There may be the potential for slash piles to damage mycorrhizae if too hot. Adverse, negligible to moderate, short- term impacts.

There may be the potential to adversely impact sensitive or uncommon plants. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be some mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be habitat modification as a result of alterations to composition and structure. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be increases in the introduction and/or spread of disease and infestation due to slash piles and inadvertent injuries to individual plants during treatment. Adverse, negligible to major, short to long- term impacts.

Reproduction may be slowed if chip layer is too thick. Adverse to beneficial, negligible to major, short to long- term impacts.

Reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil. Adverse to beneficial, negligible to major, short to long- term impacts.

Thinning of the chaparral plant community creates a very unnatural species composition and structure. Beneficial to adverse, negligible to major, short- term impacts.

Slash piles can also lead to infestations of wind- dispersed exotic plant species. Adverse, negligible, short to long- term.

There may be increased likelihood of wildland fire ignition (reduced canopy from thinning can make conditions favorable to annual grasses – which can make ignition and spread of fire much more likely, plus conditions near the ground surface are warmer and wind can dry fuels out quicker), reduced intensity of fire, and reduced risk of crown fire. Adverse, negligible to major, short to long- term impacts.

There may be the potential to damage vegetation if fuel spills occur during treatment activities. Adverse to beneficial, negligible to major, short to long- term impacts.

Cumulative

Reduction and rearrangement of fuels increases the chances of managing wildland fires effectively.

Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species.

Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1.

Impacts Specific to Alternative I in the chaparral plant community.

Prescribed Fire

Prescribed fire is expected to stimulate diversity in both native and non- native plant species and to break- up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires. Chaparral Vegetation Community is still well within the normal range of variation in regards to the natural fire regime.

Shaded Fuel Breaks

Direct

There may be direct mortality and damage to vegetation. May have adverse and beneficial, negligible to major, short to long- term impacts.

Unnatural vegetation and structure for this plant community. Beneficial to adverse impacts, negligible to major, short to long- term.

Fuel levels are reduced or rearranged. Beneficial, negligible to major, short to long- term impacts.

There may be the potential for fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be the potential to cause damage or mortality to sensitive species. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be some mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

Habitat fragmentation as a result of 100- foot wide swaths of altered vegetation. Adverse, negligible to major, short to long- term impacts.

Shaded fuel breaks create landscape heterogeneity – causing edge effect for some species. Beneficial, negligible to moderate, short to long- term impacts.

There may be the potential for introduction or expansion of exotic plant species. Adverse, negligible to major, short to long- term impacts.

There may be an increased potential to introduce and spread disease and infestations. Adverse , negligible to major, short to long- term impacts.

Reproduction may be affected if chip layer is too thick. May have adverse to beneficial, negligible to major, short to long- term impacts.

Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil. May have adverse to beneficial, negligible to major, short to long- term.

There may be an increased potential of ignition and spread of wildland fires (lack of canopy cover promotes annual grasses), as well as reduced risk of large and intense fires. Adverse to beneficial, moderate, short to long- term impacts.

There may be the potential for impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term impacts.

There may be the potential for increased recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term impacts.

Cumulative

There may be long- term changes in composition, structure and function.

Repeated treatments in this habitat type would increase the chance to introduce and spread exotic plant species, disease, and infestations.

Increase in annual grasses and higher temperatures at the soil surface would result in higher probability of wildland fire ignition, and a greater chance of type- conversion.

Understory herbaceous species would be significantly reduced or eliminated.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removal of ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur - annual grasses would be selected for under this alternative.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and severity over time. The National Park Service may not impair park resources or values. There may be additional long- term impacts to chaparral plant communities related to management actions proposed for this alternative, (particularly related to the installation and maintenance of a shaded fuel break network) that cannot be predicted at this time. Impairment of chaparral plant community would include type conversions to annual grasslands and the loss or hydrophobicity of soils

Alternative II

Please review the Issues and Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative II in the chaparral community.

Prescribed Fire

The following impacts are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire.

Direct

There may be some mortality and damage to vegetation during pre- fire thinning and construction of prescribed fire burn unit boundaries. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be some mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire would trigger germination of fire- adapted plants – seasonality depending. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential for prescribed fire to escape, possibly becoming a large, unmanageable/severe wildland fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential fuel spill to damage vegetation not consumed during prescribed burn activities. Adverse, negligible to major, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

Management ignited fires in the spring can result in a type conversion to chemise. This can increase the probability of ignitions and rates of spread. Adverse, major, long- term.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees.

Burn piles can also sterilize the soil in localized spots, which enables wind- dispersed and weedy species the upper hand in colonization, resulting in patches of infestations. Adverse, negligible to major, short to long- term impacts.

There may be the potential to introduce and/or spread pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor. Negligible to major, adverse, short to long- term impacts. Negligible to major, adverse, short to long- term impacts.

There may be the potential prescribed fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long- term impacts.

Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long- term impacts.

Thinning associated with prescribed fire activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long- term impacts.

Prescribed fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Prescribed fire reduces the potential for large and intense wildland fires. Beneficial, moderate, long- term impacts

Prescribed fire reduces the intensity of subsequent wildland fires. . Beneficial, moderate, long- term impacts

There may be the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Prescribed fire is expected to stimulate diversity in both native and non- native plant species. It is also expected to break- up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires.

Shaded Fuel Breaks

Indirect

Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrow. Beneficial to adverse, negligible to major, short to long- term impacts.

Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers. Adverse, negligible to major, short to long- term impacts.

There would be less of a chance to control the fire size. Adverse, negligible to major, short to long- term impacts.

Cumulative

Continuous distribution of high fuel loadings across the landscape can reduce the fire management staff's ability to control the fire size.

Understory herbaceous species would be selected for and habitat fragmentation reduced.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short- term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity of fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This would also increase overstory mortality of desired large trees. Spring burning can also result in more flammable fuels in the chaparral plant community (e.g., chamise).

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel break s would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of chaparral plant community would include type conversion and loss of soil horizons.

Alternative III

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative III in the chaparral community.

Prescribed Fire

Compared to the impacts discussed above, prescribed fire impacts are reduced; mainly pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 2

Brush mastication is added in Alternative III; uses medium equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment)

Direct

There may be some mortality and damage to vegetation. Beneficial to adverse, negligible to major, short to long- term impacts.

Changes in species composition and vegetation structure to a greater extent than Level 1. Results in unnatural forest structure not as much control as with Level 1 treatment. Beneficial to adverse, negligible to major, short to long- term impacts.

Fuel levels are rearranged. Beneficial, negligible to major, short to long- term impacts.

There may be the potential fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be the potential to cause damage or mortality to sensitive species and non- target vegetation. Adverse, negligible to major, short to long- term impacts.

There may be the potential to damage or destroy sensitive or uncommon species. Beneficial, negligible to major, short to long- term impacts.

Indirect

There may be inadvertent mortality from damage that occurred during treatment. Beneficial to adverse, negligible to major, short to long- term impacts.

Increased potential to introduce and spread exotic plant species. Adverse, negligible to major, short to long- term impacts.

There may be habitat modification as a result of alterations to understory composition and structure. Beneficial to adverse, negligible to major, short to long- term impacts.

Seasonality of burning off the slash would either greatly enhance exotics or suppress them. Leaving the slash could mitigate this. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be increased introduction and spread of disease and infestation as a result of injury to trees during treatment. Adverse, negligible to major, short to long- term impacts.

Reproduction, including sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae. Beneficial to adverse, negligible to major, short to long- term impacts.

Increased likelihood of wildland fire ignition and spread reduced risk of crown fire and extreme fire behavior or large and unmanageable fires. Beneficial, negligible to major, short to long- term impacts.

There may be the potential impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major, short to long- term impacts.

Cumulative

There may be long- term changes in vegetation composition and structure.

There may be the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions.

Some management actions (all mechanical treatment levels and prescribed fire – basically repeated disturbance of any kind) would greatly enhance exotic plant infestations.

Impacts would be similar to mechanical level 1, but greatly increased – both beneficial and adverse.

Shaded Fuel Breaks

Please review impacts associated with Shaded Fuel Breaks found in Alternative II for this vegetation community.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce make large and intense fires more manageable. Burn piles may escape to become wildland fires, with a greater chance of exotics and increased probability of ignition and spread.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would result in direct impacts on the vegetation.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non- woody response, plant diversity, disease and insect infestation, and genetic diversity are unclear. More data is needed. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the chaparral community would include type conversion and loss or hydrophobicity of soils.

Alternative IV

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. Alternative IV adds mechanical level 3 (small- scale logging) to mechanical treatment options. What follows is a discussion of the impacts specific to Alternative IV in the chaparral community.

Mechanical Treatment Level 2

In addition to the impacts discussed for this vegetation community in Alternative III, the following is noted:

Cumulative

Long- term changes in composition and structure and the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre- treatment conditions.

Mechanical Treatment Level 3

Small- scale logging with a higher intensity than mechanical treatments for both level 1 and 2 would occur. This approach would be considered for dense thickets of knobcone pine that occur within the chaparral community.

Direct

There would be some obvious mortality and damage to vegetation—the removal of trees. Beneficial to adverse, negligible to major, short to long- term impacts.

Changes species composition and vegetation structure to a greater extent than Level 1 and Level 2. Beneficial to adverse, negligible to major, short to long- term impacts.

Fuel levels are reduced. Beneficial, negligible to major, short to long- term impacts.

There may be the potential fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be the potential to cause damage or mortality to sensitive species. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be the potential to damage or destroy sensitive or uncommon species. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be the potential to damage soil microorganisms. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be some mortality from damage that occurred during treatment. Beneficial to adverse, negligible to major, short to long- term.

There may be the potential to increase exotics. Adverse, negligible to major, short to long- term impacts.

There may be habitat modification as a result of alterations to composition and structure. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be increased introduction and spread of pathogens. Beneficial to adverse, negligible to major, short to long- term impacts.

Reproduction may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae. Beneficial to adverse, negligible to major, short to long- term impacts.

Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil. Beneficial to adverse, negligible to major, short to long- term impacts.

Slash piles could increase the introduction and spread of exotic plant species. Adverse, negligible to major, short to long- term,

There may be reduced fire severity. Beneficial to adverse, negligible to major, short to long- term impacts. There may be the potential impacts to vegetation if fuel spills occur during treatment activities. Beneficial to adverse, negligible to major, short to long- term impacts.

Cumulative

Long- term changes in composition and structure with understory herbaceous species selected against.

Shaded Fuel Breaks Under Alternative IV

The number of shaded fuel breaks is expanded from Alternative III, and the width is doubled from the present 100 feet to 200 feet along roads. Ridge shaded fuel breaks remain at 100 feet in width.

Direct

There may be some mortality and damage to understory vegetation on a larger scale than mechanical treatment. Beneficial to adverse, negligible to major, short to long- term impacts.

There may be species composition and vegetation structure outside the range of natural variability. This may have both beneficial and adverse impacts, negligible to major, short to long- term impacts.

Fuel levels and ladder fuels are reduced. Beneficial, negligible to major, short to long- term impacts.

There may be the potential fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be an increased potential to cause damage or to sensitive species and overstory tree species. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be inadvertent mortality from damage that occurred during treatment. Adverse, negligible to major, short to long- term impacts.

Increased habitat fragmentation impacts as a result of 200- foot wide swaths of altered vegetation. Adverse, moderate to major, short to long- term impacts.

There may be greater potential for introduction or expansion of exotic plant species. Adverse, negligible to major, short to long- term impacts.

There may be increased probability to introduce and pathogens as a result of inadvertent injury to trees during treatment. Beneficial to adverse, negligible to major, short to long- term impacts.

Reproduction may be affected if chip layer is too thick. Beneficial to adverse, negligible to major, short to long- term impacts.

Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and/or damages overstory canopy trees. This can also lead to localized infestations of wind-dispersed weedy species. Adverse, negligible to major, short to long- term impacts.

Increased potential for ignition, reduced fire intensity, reduced risk of large and intense fires, provides access and escape routes for fire crews. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be the potential impacts to vegetation if fuel spills occur during treatment activities. Adverse, negligible to major short to long- term.

Increased potential to introduce and spread pathogens – especially if slash piles are not burned and or chipped immediately.

There may be the potential increased impacts to the chaparral plant community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Adverse, negligible to major, short to long- term impacts.

Cumulative

There may be the potential long- term changes in composition and structure with understory herbaceous species are selected against. There may be long- term impacts that are unknown at this time.

Wildland Fire Use

Wildland Fire Use is a component in Alternative IV, however it would not be used in the chaparral plant community.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the chaparral community would include type conversions—which is most likely in this plant community—and loss of soils or hydrophobicity of soils.

Riparian Vegetation

Issues and Impacts/Issues Common to All Alternatives

Suppression Standards

The following standards should be recognized in order to evaluate suppression actions in the riparian vegetation community. Hand line construction in riparian areas is a possibility. Engine crews may lay hose across riparian areas. Fire fighters may create safety zones by clearing vegetation in a riparian area. Aircraft may drop water in a riparian area. Port- a- pumps may be needed to pump water from a water source surrounded by a riparian area. Fuel spills from chainsaws and drip torches may occur in a riparian area. Management ignited backfires may burn riparian areas. Fire retardant drops are to stay 300 feet from intermittent and perennial streams. Foam could be used on vegetation in riparian areas.

Suppression

Direct

There may be some mortality of individual trees, shrubs, and understory species related to construction of fire lines (mostly from the use of hand tools and chain saws and engines filling up their tanks). Adverse short to long- term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity.

There may be felling of large trees to facilitate fire suppression activities. Beneficial to adverse, negligible to major, short- term to long- term impacts depending on site specifics.

There may be damage to vegetation from fire crews and fire line construction activity and engines. Adverse, negligible to major, short- term impacts depending on site specifics.

There may be some mortality or damage to vegetation from aircraft water drops and high- pressure hoses used to suppress fire. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

There may be fuel accidentally spilled from port- a- pumps, chain saws and drip torches during fire suppression activities may kill vegetation. Adverse, minor to major, short to long- term impacts depending on size and location of spill.

There may be some mortality and damage to vegetation from management- ignited fires (burn- outs/back- burns). Beneficial to adverse, negligible to major, short to long- term impacts depending on site specifics.

There may be some potential impacts to vegetation from foams (ingredients of foam = detergents). Adverse, negligible to moderate, short- term impacts, depending on site specifics.

Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, or, if known, not taken into consideration during initial attack/suppression activities. Beneficial or adverse, minor to major, short to long- term impacts depending on species, activity, level of intensity.

There may be some mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression. Adverse, negligible to moderate, short to long- term impacts depending on site specifics.

Indirect

There may be some mortality occurring after fire suppression resulting from damage during suppression activities. Beneficial to adverse, moderate to major, short to long- term impacts, depending on site specifics.

Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out- compete and replace native plant species. Adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species. Adverse, moderate to major, short to long- term impacts.

Potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. More data is needed.

There may be the potential to contribute to bark beetle, fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Habitat would be altered in areas where firelines, safety zones, were constructed. Alterations include species composition, structure and function. Beneficial to adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, and degree of compaction.

There may be the potential impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill.

Mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration. Adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Sensitive and threatened and endangered species and large overstory trees are protected where fire is suppressed; fire- adapted sensitive species may not do well if fire is suppressed. Beneficial to adverse, negligible to major, short to long- term. More data is needed.

The potential for type- conversion related to a high severity wildland fire would not occur if suppression activities are successful. Beneficial, major, long- term.

Reduction of overstory trees can increase the amount of light that reaches streamside and aquatic plant species. This can negatively impact light intolerant and temperature dependent species.

Cumulative

Most riparian plants are not adapted to fire, although historically and rarely, fire has played a role in riparian ecosystems. Overall, fire suppression activities in the riparian plant community would alter the composition, structure, and function of this plant community; this impact is additive to historical uses and management actions, including logging, mining, development, road building, dam construction, and recreational use.

The natural fire cycle is interrupted and fire adapted species are denied the beneficial impacts of fire.

If suppression activities are successful, the adverse impacts of a large and intense fire with extreme fire behavior are prevented. Riparian plant communities would benefit at the landscape and watershed scale.

Prescribed Fire Standards

The following standards should be recognized in order to evaluate prescribed fire actions in the riparian vegetation community.

No hand ignition would occur in the riparian areas. Fire would be allowed to back into a riparian area. Hand- lines construction would not be allowed in a riparian area. Hose lays would not be conducted, and port- a- pumps would be avoided because of contamination to creeks. Fuel spills from chainsaws and drip torches may occur. No foam or retardant use would occur. Site- specific thinning (mechanical treatment level 1) would be conducted in a manner that protects overstory trees and species of concern. These overstory trees provide canopy cover along the riparian corridor and would be protected - especially along perennial streams. Intermittent streams would be protected as well, but this is less critical because fire probably occurred in these systems naturally. Spring burning in riparian areas would be avoided due to wildlife concerns.

Prescribed Fire

Direct

There may be some mortality and damage to vegetation during pretreatment operations. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be some mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction may be negatively impacted by the loss of seeds, acorns, and bulbs. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire may trigger germination of fire- adapted plants (native and exotic). Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential prescribed fire to escape, possibly a becoming wildland fire; possibly large, severe and unmanageable fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially may compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

Potential to introduce and/or spread contribute to beetles and pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

Soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor. Moderate to major, adverse, short to long- term impacts.

There may be the potential prescribed fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long- term impacts.

Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long- term impacts.

Thinning associated with prescribed fire activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long- term impacts.

Prescribed fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Prescribed fire mimics natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Prescribed fire reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires. Beneficial, moderate, long- term impacts.

Potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Overall, most riparian plants and overstory trees (e.g., yew and alder) are not adapted to fire whereas some respond vigorously.

Mechanical Treatment Level I- Standards

The following standards should be recognized in order to evaluate mechanical treatment level 1 actions in the riparian vegetation community.

Site- specific thinning may occur to protect overstory trees and shrubs for prescribed fire and wildland fire use. Shaded fuel breaks would provide a 100- foot buffer on both sides of perennial creeks and streams and a 50- foot buffer for intermittent streams. No slash piles or pile burning would occur in riparian areas.

Mechanical Treatment Level I

Direct

There may be some mortality and damage to a limited number of specific trees and shrubs. Beneficial to adverse, negligible, short- term impacts.

Fuel levels are reduced. Beneficial, moderate, short to long- term impacts.

There may be the potential fuel spills. Adverse, negligible to major, short to long- term impacts.

There may be the potential to cause damage or mortality to sensitive and overstory tree species. Adverse, negligible to major, short to long- term impacts.

There may be the potential to adversely impact sensitive or uncommon plants. Adverse, negligible to major, short to long- term impacts.

Indirect

There may be inadvertent damage/mortality from damage that occurred during treatment. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be the potential to introduce and spread exotic plant species. Adverse, minor to major, short to long- term impacts.

There may be microhabitat modification as a result of alterations to composition and structure. Adverse to beneficial, negligible to minor, short- term impacts.

Increase in the introduction and/or spread of disease and infestation due to inadvertent injuries to individual plants during treatment. Adverse to beneficial, negligible to major, short to long-term impacts.

There may be the potential to damage vegetation if fuel spills occur during treatment activities. Adverse to beneficial, negligible to major, short to long- term impacts.

Cumulative

If done correctly, pre- treating specific areas that are heavily stocked with decadent and dead-standing fuels can increase the chances of preserving riparian areas from the adverse impacts of a severe wildland fires.

Alternative I

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removing ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire. From a watershed standpoint, the treatment of fuels in the high elevation mixed conifer and ponderosa plant communities, can reduce the size and intensity of wildland fires. In doing so, this lessens the chance of debris flows and other watershed events that can permanently alter riparian communities.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. There may be additional long- term impacts to riparian plant communities related to management actions proposed for this alternative, (particularly related to suppression activities and the indirect effect of activities in neighboring plant communities) that cannot be predicted at this time. Impairment of community would include irreversible/long- term changes in the riparian community structure and composition.

Alternative II

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a review of the impacts specific to Alternative II in the riparian community.

Shaded Fuel Breaks

Indirect

Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrowth. Beneficial to adverse, negligible to major, short to long- term impacts.

Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of riparian areas. Adverse, negligible to major, short to long- term impacts.

There would be less management flexibility in controlling the fire size. Adverse, negligible to major, short to long- term impacts.

Cumulative

Continuous distribution of high fuel loadings across the landscape reduces the potential to control the fire size.

No potential to eliminate or significantly reduce understory species, or those adapted to the pre-treatment conditions.

No potential for habitat fragmentation resulting from the construction of linear features (burn-unit boundaries).

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short- term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel break s would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the riparian plant community would include significant changes to vegetation community structure and composition (loss of canopy cover, increased light and temperature at the surface and in the water) and spring burning.

Alternative III

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a review of the impacts specific to Alternative III in the riparian community.

Mechanical Treatment Level 1

Cumulative

Short- term, negligible to moderate changes in composition and structure with the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions.

Mechanical Treatment Level 2

Brush mastication would not be applicable in the riparian plant communities.

Brush masticators would provide a 100- foot buffer on both sides of perennial creeks and streams, and a 50- foot buffer for intermittent streams.

Shaded Fuel Breaks

Shaded fuel break construction would not be applicable in riparian plant communities.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would have direct effect on the vegetation.

Conclusion

Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the riparian plant community would include significant changes to vegetation structure and composition (loss of canopy cover, increased light and temperature at the surface and in the water) and spring burning.

Alternative IV

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative IV in the riparian community.

Mechanical Treatment Levels 2 and 3

Brush mastication and small- scale logging would not be applicable in the riparian plant communities.

Brush masticators and small- scale logging would provide a 100- foot buffer on both sides of perennial creeks and streams, and a 50- foot buffer for intermittent streams.

Shaded Fuel Breaks

Shaded fuel break construction would not occur in riparian plant communities.

Wildland Fire Use Standards

Wildland fire would be allowed to back into riparian areas. No hand- lines, hose lays, port- a- pumps, foam or retardant use would occur in a riparian area. Fuel spills could occur from chainsaws and drip torches. Site- specific thinning (mechanical treatment level 1) would be conducted in a manner to protect overstory trees providing canopy cover and species of concern along the riparian corridor - especially along perennial and intermittent streams.

Wildland Fire Use

Direct

There may be some mortality and damage to vegetation during pretreatment operations. Adverse to beneficial, negligible to major, short to long- term impacts.

There may be some mortality and damage to vegetation as a result of management ignited fires. Adverse to beneficial, negligible to major, short to long- term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre- burn and burn activities if they are not identified in a pre- burn survey. Adverse to beneficial, negligible to major, short to long- term impacts.

Plant reproduction may be negatively impacted by the loss of seeds, acorns, and bulbs. Adverse to beneficial, negligible to major, short to long- term impacts.

Fire may trigger germination of fire- adapted plants (native and exotic). Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential fire to escape, possibly a becoming wildland fire; possibly large, severe and unmanageable fire. Negligible to major, adverse to beneficial, short to long- term impacts.

There may be the potential damage or mortality resulting from accidental fuel spills. Negligible to major, adverse, short to long- term impacts.

Fires would decrease nutrient availability and organic matter. Negligible to major, adverse to beneficial, short to long- term impacts.

If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Indirect

Exotic plant species may be introduced and spread within prescribed burn units. Negligible to major, adverse, short to long- term impacts.

Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially may compress the fire return interval. Negligible to major, adverse, short to long- term impacts.

There may be some mortality of vegetation damaged during pre- fire and prescribed fire activities. Negligible to major, adverse, short to long- term impacts.

There may be the potential to introduce and/or spread contribute to beetles and pathogens such as fungi. Negligible to major, adverse, short to long- term impacts.

There may be soil disturbance/compaction as a result of pretreatment activities may result in increased exotics, or decreased native plant vigor. Moderate to major, adverse, short to long- term impacts.

There may be the potential fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long- term impacts.

Thinning associated with pretreatment actions may result in increased insolation and soil temperatures, and decreased moisture. Negligible to major, beneficial to adverse, short to long- term impacts.

Thinning associated with pretreatment activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long- term impacts.

Fire can stimulate fire- adapted species. Beneficial, moderate, long- term impacts.

Wildland fire use returns natural fire in the ecosystem. Beneficial, moderate, long- term impacts.

Wildland fire use reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires. Beneficial, moderate, long- term impacts

There may be the potential to enhance ethnobotanical uses. Beneficial, moderate, long- term impacts.

Fires may have a long- term effect on plants by either increasing or decreasing nutrient availability. Beneficial to adverse, moderate, long- term impacts.

Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re- growth of vegetation. Adverse, moderate to major, short to long- term impacts.

Cumulative

Overall, most riparian plants and overstory trees (e.g., yew and alder) are not adapted to fire whereas some respond vigorously.

Wildland fire use best mimics the natural fire regime and is second to prescribed fire for returning fire to the landscape for riparian plant communities.

Short- term use versus long- term enhancement of resources

Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources

No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts

Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion

Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. Impairment of the riparian plant community includes major changes in the vegetation structure and composition in such a way that changes the microhabitat characteristics of the riparian community (e.g., loss of overstory trees). Impairment also includes the loss or hydrophobicity of soils.

Special status plants

Fire management is an intrinsic part of managing sensitive species and habitats. The methodology and purpose for the fire management process may vary substantially, to protect and preserve native species in their natural environments and to promote the continued functioning of natural ecosystems.

Plant species that are Federally or State listed as Threatened or Endangered, listed by the California Native Plant Society, or considered sensitive or uncommon may experience mortality, damage, or decreased reproduction rates if present in suppression areas. Impacts would be identical to those outlined above for various actions to other plants, but severity of impact would be increased due to the fact that these are rare species. While the location of some of these species is well documented, most of the park lacks surveys and presence/absence of species is not known. Protection of Threatened, Endangered, rare, or sensitive plant species cannot reasonably be taken into consideration during initial attack/suppression activities. No field markers are installed to alert crews to environmentally sensitive areas, and no system is in place to ensure that responding crew leaders be made aware of the need to try to protect rare species. Impacts would range from beneficial to adverse, minor to major, and short to long-term depending on species, activity, and level of intensity. For example, Shasta County arnica (*Arnica venosa*) seems to thrive in disturbed areas such as road cut banks and shaded fuel breaks. Such a species may experience beneficial impacts from suppression activities; however, more data is needed.

Suppression

Suppression actions may have no direct impacts on sensitive plants in some areas, as many sensitive species occur in relatively steep inaccessible sites. Initial attack activities could have adverse direct impacts on sensitive species if firefighters are not made aware of the location of the plants and the need to avoid trampling, retardant and water drops, hose lays, and other actions. More data is needed on the impacts of fire and impacts from fire suppression to the sensitive species that are found in the park and their status.

Some species may be adapted to fire and other disturbance regimes, and those species would be expected to increase in numbers. These impacts would be *indirect, beneficial, long-term, and moderate*. Decrease or elimination of sensitive plant species may occur if they are sensitive to fire or trampling and these impacts would be direct or indirect, adverse, long-term, and major.

Seasonality of fire is also a factor to consider in assessing potential impact; for example, fire in spring may wipe out entire populations of plants and therefore seed for the following year. Spring burning may also affect top parts of bulbs and thus the ability of the plant to store food for next year, or seeds on and under the soil. These impacts could be direct/indirect adverse/beneficial, short to long term, negligible to major.

Disturbance across slopes and drainages can result in loss of topsoil, and seeds or bulbs of sensitive plants; mop- up churns up ash and soil that may contribute to loss of seed and below-ground structures by exposing them to heat and flames. Hand lines and mop- up actions disturb vegetation and soil, and trample or bury sensitive plants. Ground disturbance would also result from the establishment of helispots, dozer lines and spike camps. These impacts would be direct, adverse, short term, negligible, minor, and moderate.

Some sensitive species require frequent burning; others are early successional taxa, while others prefer a specific microenvironment for optimal population size and vigor. Timing, intensity, and frequency of proposed actions are key factors in the biological evaluation of proposed activities. A fire activity could have no affect, adverse affect, or beneficial effect depending on if the action was evaluated with the specific ecological needs of the plant in mind. Data needed includes type of management individual species need to assure long- term conservation, as some require prescribed management treatments, while others just need to be protected and left alone. Long range species and/or habitat management guides must be prepared and incorporated into management plans.

Potential adverse impacts to sensitive plants from suppression actions can be mitigated by surveying shaded fuel breaks and prescribed fire units in the spring at the appropriate flowering time to locate sensitive species. Thick brush makes it impossible to survey in some areas to accurately identify isolated individuals, and no consideration of sensitive species can reasonably be given during wildland fire initial attack activities when safety is the highest priority. Geographic information system (GIS) layers are being developed for sensitive plants and other ecologically sensitive areas, enabling fire managers the ability to eliminate or control ground-disturbing activities in these areas as much as possible. Soil disturbance may be mitigated by rehabilitation of topography by replacing soil layers and rocks. Other mitigations include consultation with natural resources staff, checking the park GIS layer for locations, avoidance of known sensitive species when possible, the restoration of local litter and duff, and rehabilitation of natural grade and drainage.

Mechanical treatment, prescribed fire and wildland fire use

Potential impacts to sensitive species from thinning or burning depend on a number of variables such as the timing of those events (cumulative impacts). The life form, habitat, and phenology of these rare species must be taken into consideration as described in the table below. All plants are listed in the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California, 6th Edition (2001).

Table 4-1 Whiskeytown sensitive plant species type, habitat and seasonality.

Species	Life form	Habitat	Blooming
<i>Allium sanbornii</i>	perennial herb (bulb)	chaparral, oak woodland	May-September
<i>Allium tribracteatum</i>	perennial herb (bulb)	chaparral, oak woodland	April-July
<i>Arnica venosa</i>	perennial herb	mixed conifer, oak woodland	May-June
<i>Clarkia mildrediae</i>	annual	mixed conifer	June-July
<i>Clarkia virgata</i>	annual	oak woodland, mixed conifer	May-July
<i>Cypripedium fasciculatum</i>	perennial herb (rhizome)	mixed conifer	March-July
<i>Eleocharis parvula</i>	perennial herb	alkali wetland	June-September
<i>Juncus marginatus</i>	perennial herb (rhizome)	alkali wetland	July
<i>Linanthus rattanii</i>	annual	oak woodland	May-July
<i>Navarretia heterandra</i>	annual	vernal wetland	May-June
<i>Penstemon purpusii</i>	perennial herb	mixed conifer (rock outcrop)	June-August
<i>Puccinellia howellii</i>	grass	alkali wetland	April-June
<i>Sagittaria sanfordii</i>	perennial herb	Freshwater marsh	May-August
<i>Sedum paradisum</i>	perennial herb	chaparral (rock outcrops)	May-June
<i>Trillium ovatum</i>	perennial herb	mixed conifer forest	February-May
<i>Triteleia crocea</i>	perennial herb (bulb)	mixed conifer (rocky)	May-June

Under normal circumstances, *Eleocharis parvula*, *Juncus marginatus*, *Puccinellia howellii*, and *Sagittaria sanfordii* would be protected from the impacts of wildland fire and fire management activities due to their wetland habitats. Species that tend to occur on rock outcrops such as *Penstemon purpusii*, and *Sedum paradisum* may also be protected from impacts. These species would be top killed and would resprout, if they burn in a wildland fire.

Mechanical treatment levels 1 and 2 could have direct adverse impacts on sensitive plants due to foot and/or machine traffic trampling annuals and bulb plants, particularly in spring. When the tops of bulb plants are lost for the year, annual carbohydrate storage could be reduced, resulting in less energy for the next season. Similarly, annuals could lose seed production for a year. Most species of *Clarkia*, for example, do not form persistent seed banks, and rely on annual seed production for growth the following year. (Baskin and Baskin 1998). More data is needed. Surveying for rare plants ahead of time in spring and summer and avoiding them could mitigate these impacts.

Indirect adverse impacts from thinning include increased solar radiation, which would increase light and temperature and lower soil moisture, and may negatively impact species such as *Trillium ovatum*, and possibly *Cypripedium fasciculatum*. Growth could be suppressed if material is chipped into areas inhabited by these species. In particular, the annuals could germinate and fail to emerge through the chips (Bond and van Wilgen 1996).

Prescribed fires are not anticipated to affect wetland or rock outcrop plants under normal circumstances. Plants with bulbs or rhizomes have deeply buried tissues that typically survive fire. Natural fires historically occurred during summer or fall, when these (sensitive?) plants are dormant, and contain seasonally low tissue moisture, which contributes to fire tolerance. Spring burning could have adverse impacts on these species by consuming green leaves and because bulbs are less fire tolerant in the spring. Decreased fire tolerance may be mitigated by reduced soil heating during spring, when fuel and soil moisture is relatively high.

Annual species would lose their seed crop if prescribed fires were conducted prior to seed release. This is not likely to be before mid- summer for *Clarkia* species. If annuals such as most *Clarkia* species do not maintain a persistent seed bank, continuation of the species is dependent on annual seed production. Interrupting this production with fire could result in temporary extirpation, although with windblown seed, *Clarkia* can re- colonize a site. For species that

maintain a persistent seed bank such as *Linanthus* and *Navarretia*, a spring burn when soils are moist would cause greater mortality compared to a dry season burn, because seed that absorbs moisture seasonally is sensitive to heating unless it is relatively desiccated (Sweeney 1956).

Fire eliminates accumulations of thatch from annual grasses, and may create more favorable conditions for native species such as *Clarkia* in grasslands. On the other hand, fire can promote the spread of invasive exotics like broom and thistles (Odion and Haubensak, In Press).

Although the sensitive plants have existed with wildland fire throughout their existence, fires today could have impacts differing from those in the past. In particular some areas where past logging has occurred may be more prone to crown fire. However, sensitive plants are not likely to be found in these areas, or are confined to rocky situations where fire impacts would be unchanged. Where grass is the primary fuel, fires may occur earlier in the season now than historically because the introduced exotic European annuals cure faster than the native perennial grasses.

Suppression activities during a wildland fire may damage or kill rare plants. Of particular concern, dozer lines may cut deeply enough into the soil to dislodge bulb plants. This impact would be direct, adverse, moderate, and long term to the individual dislodged bulb plants. Sensitive plants in areas of crown fire may survive, but resulting changes in the conditions in the forest understory may have beneficial or adverse indirect impacts. Sunlight, warmth, and soil nutrients would increase initially, and competition from adjacent plants may decrease. Moisture may become more limiting earlier in the summer because of decreased infiltration due to hydrophobic soils.

Invasive and exotic plants

Most exotic plant species are adapted to disturbance, and fire and fire suppression activities as well as other disturbances generally appears to increase existing exotic plant populations, and may result in exotics being introduced to new areas. Seed and plant material is constantly supplied along road and drainage corridors and brought into un- infested areas on equipment, clothing, and footwear. Exotic seed makes its way to relatively un- infested land by wind, water, livestock, vehicles, and equipment.

Fire management activities can inadvertently lead to the spread of exotics. Firebreaks create gaps that allow the spread of invasive plants. Not cutting lines through established patches of exotics, and washing equipment and vehicle tires before they leave the area can minimize spread. The spread of exotics resulting from rehabilitation following fire can be minimized with the use of certified weed- free mulch and native grass seed. Prescribed fire can be used as a tool to decrease certain exotics if applied at the correct time and re- treated annually with by fire or herbicide (Brooks 2001). Other studies support the hypothesis that exotic annuals proliferate in frequently disturbed areas, and native plants would dominate when disturbance frequencies are low (Giessow and Zedler 1996).

The effect of burning as a control strategy for star thistle shows conflicting results. Some studies show that repeated burning can be an effective tool to reduce star thistle by 62 to 85 percent (DiTomaso 1995). Correct timing of the burns is critical to achieve desired results, reducing or eliminating the number of live plants, as well as reducing the seed bank by significant amounts (Hastings and DiMataso 1996). Burns conducted at the incorrect phenological stage, or not conducted for several consecutive years, have been shown to actually increase star thistle. Other studies show that prescribed burning used alone is not effective as very little seed kill occurs (Huston, et al 1984), and that burning, in most cases, increases plant size and seed production by providing additional nutrients (Sheley, et al circa 1996). Sufficient fuels such as dry grasses must

be available to carry the fire effectively, and plants that are scorched but not consumed by fire may resprout from the base (Martin and Martin, 1999). The effect of fire on broom species is probably mixed; although fire would remove the above-ground portion, it may stimulate seed production (Mobley 1954, Johnson 1982).

Some studies show a significant decrease in exotic grasses and an increase in native forbs and shrubs following fire (Kan and Pollack 1977). Other studies and anecdotal evidence appear to support the increase of some grasses such as brome (*Bromus rubens*) following fire (Johnson and Smathers 1974).

The potential spread of exotics from fire and fire-related activities would be mitigated by the use of previously disturbed sites for helispots and spike camps when available, treatment of exotics prior to fire, education, and requirements that all equipment, clothing and boots would be free of exotic seed, and care in restoration techniques so as to not spread exotic seed banks already existing in soil. Whether any fire improves or degrades species habitat depends on their life requirements in comparison to the nature of the new vegetation. However, the enhancement of growing condition for aggressive exotic species changes the scenario. The exotic giant reed (*Arundo donax*) grows readily in the same habitat as willow thickets. Willows normally resprout vigorously after fire and would quickly occupy a site but the invasion of *Arundo* caused a dramatic adverse (Keeley and Fotheringham 2001).

Fire suppression impacts on the spread of exotics may be beneficial or adverse. Densities of existing exotic plant infestations may increase, exotic plant species may be introduced to new areas, and exotic plant species previously unknown in the park could be introduced by fire suppression activities including initial attack. Fire itself may decrease the seed bank of some exotic species if it occurs at the time of year that coincides with the height of seed production for that particular species. Broom populations appear to increase following a single fire, but decrease with repeated applications of fire (Odion). Exotic avenues may be opened with hand lines, the creation of helispots and spike camps, and restoration efforts. Following wildland fire, ideal seedbed conditions favor the germination of weed seeds. Yellow star thistle seed, for example, appears to be dependent on light, which accounts for high densities in exposed areas. (Martin and Martin Prescribed Burning and Competitive Reseeding etc. Date? Journal?) Other factors that may favor exotics are reduced competition from native plants, and increased nutrient availability. Many studies have demonstrated that exotic grasses are good competitors against herbaceous and woody species (Bush et al 1989, Knoop and Walker 1985, Litave et al 1963, Schultz et al 1955).

The presence of exotic species appears to influence fire intensity and shorten fire intervals. Repeated, frequent fires in California coastal scrub offer opportunities for the establishment of exotic grasses and forbs and favor their growth, and have a correlating increase in densities with shorter fire free intervals. This increases the probability of wildland fire by providing more fine fuels in vegetation that is repeatedly burned (Giessow and Zedler 1996). Exotic grasses such as cheatgrass are promoted by repeated burning while natives such as Idaho fescue are susceptible to severe damage by fire due to hot lingering fire burning in the basal tufts where incipient buds are located (Johnson, Charles, 1998). Fine size classes of fuel, characteristic of sites invaded by exotic annual grasses, ignite and spread fires under a broader range of conditions than woody material or leaf litter (Rundel 1981). High cover of exotic species in shrub systems enable fires to occur in a greatly compressed cycle (Zedler et al 1982), allowing for abruptly changing succession patterns, even in fire adapted communities (Giessow and Zedler 1996). More grass cover is associated with more damage while forbs retard impacts of fire, and damage decreases with increased elevation. These impacts would be direct, adverse, and short to long-term, negligible to major.

Wildlife

Fire has played an important part in the formation of the structure, distribution, and diversity of wildlife habitats in the Klamath Mountains. As a result, wildlife native to the area have developed behaviors and characteristics that are adapted to the influence of fire on their habitat. Natural increases and decreases in different wildlife species occur as habitats change in response to fire.

Historic mining and logging activities along with fire suppression activities throughout the 20th century have caused some wildlife habitats to be dramatically changed and, in many cases, increasingly susceptible to catastrophic stand-replacing fires. Such changes have been detrimental to the natural diversity, abundance, and distribution of wildlife within the park. In addition, fire control activities can adversely affect wildlife through direct disturbance of animals and habitats, management actions designed to benefit habitat, such as prescribed fire, can have inadvertent adverse effects on wildlife. With these factors in mind, the following parameters were used to evaluate the effects of the various alternatives given in this document.

Type of Impact

Adverse: Likely to result in unnatural changes in the abundance, diversity, and distribution of wildlife species. Changes could occur through direct disturbance of mortality, or through destruction or alteration of habitat.

Beneficial: Likely to protect and/or restore the natural abundance, diversity, and distribution of wildlife species. This would occur through protection and restoration of the natural structure, succession, and distribution of habitat.

Duration of Impact

Short-term: Immediate changes in the abundance, diversity, and distribution of wildlife species, but a return to the original condition within 20 years, without further impacts.

Long-term: Changes in the abundance, diversity, and distribution of wildlife species that persist for more than 20 years.

Intensity of Impact

Negligible: Imperceptible or undetectable impacts.

Minor: Slightly perceptible, and limited in extent. Without further impacts, adverse impacts would reverse and the resources would recover.

Moderate: Readily apparent, but limited in extent. Without further impacts, adverse impacts would eventually reverse and the resource would recover.

Major: Substantial, highly noticeable, and affecting a large area. Changes would not reverse without active management.

Impacts Common to all Alternatives.

Wildland Fire suppression. Wildland fire suppression at Whiskeytown typically involves the use of numerous techniques and strategies to control wildland fire. Techniques typically used to control wildland fire typically include hand-constructed firelines with accompanying hose lays from fire engines, aerial water drops from helicopters, retardant drops from fixed-wing aircraft, snagging operations, and bulldozer-constructed fireline. Construction of helispots, spike camps, and firefighter safety zones are sometimes used to get firefighters and necessary gear into areas that are difficult to access or to ensure safety of personnel. Mopup activities occur once the fire is contained by a fireline.

Hand Line Construction. Construction of hand lines removes and disturbs soil and forest litter, possibly affecting animals such as small mammals, amphibians, invertebrates, and ground- nesting birds. Compared to other methods of line construction, impacts can be minimized by on- site avoidance of valuable or sensitive wildlife resources encountered (e.g., raptor nests). Hand line construction often involves snag removal, the impacts of which are described below. Removal of forest litter and vegetation can lead to soil erosion and increased siltation in adjacent lakes and streams. This could have an adverse effect on aquatic species, such as fish, amphibians, and invertebrates. Impacts associated with handline construction will likely be moderate, adverse, and short- term for all alternatives. Impacts can be mitigated by careful planning of fire line construction to avoid sensitive wildlife resources and habitats, rehabilitation of fire lines, and avoidance of unnecessary line construction.

Dozer- constructed fireline. Construction of fireline by bulldozers differs from hand- constructed fireline both in magnitude and spatial extent. Dozerlines tend to result in impacts deeper in the soil profile, as well as being wider and longer. These impacts cause increases in erosion and siltation of streams, negatively impacting fish, amphibians, and aquatic invertebrates. Dozer lines also contribute to habitat fragmentation and may limit dispersal or movement among some species. Dozer lines have historically been used on high intensity wildland fires in the lower elevations of Whiskeytown where handline is often not adequate for containment. Dozer lines will not be utilized in the decomposed granitic soils of the higher elevations of the park. Impacts associated with dozer- constructed fireline are adverse, moderate, and long- term. Mitigation: Impacts from dozer- constructed fireline may be reduced by post- fire rehabilitation efforts such as mulching, seeding, planting, and construction of water bars or installation of water diversion devices.

Retardant Use. Air drops of fire retardant would have their most serious effect on wildlife through potential contamination of aquatic habitats, which could affect organisms such as fish, aquatic invertebrates, and amphibians. Park policy restricts retardant drops to 300 feet distant from streams, although accidental drops in or near streams are possible. Some terrestrial wildlife could be affected by retardant drops if they were struck by the chemicals, resulting in injury or contamination. Wildlife could also be disturbed by the low- flying aircraft. Impacts to wildlife from retardant drops is expected to be minor, adverse, and short- term. Mitigation: Avoidance of aquatic habitats and minimizing use of retardant will partially mitigate impacts.

Water Drops: Dropping water on fires from helicopter buckets would not carry the risk of chemical contamination that retardant drops would, but there would be inherent risks to wildlife. Water that is removed from small bodies of water may adversely affect aquatic organisms by depleting their habitat, or resulting in the habitat drying up prematurely in the year, although this is unlikely as Whiskeytown Lake and Clear Creek are the primary sources of water for helicopters. Helicopter buckets, either through dipping or drops, could also potentially spread aquatic diseases to non- infected populations of aquatic species. The physical impact of a water drop could adversely affect individual small animals. On the positive side, water drops can, in some circumstances, be used instead of hand lines ("wet- lining") to control fire movement. This tactic would result in less impact to soil, forest litter, and vegetation than line construction and, therefore, would have less impact on wildlife, both in intensity and duration. The impacts of water drops on wildlife would be minor, adverse, and short- term based upon possible impacts to aquatic ecosystems, especially in relation to amphibians. Mitigation: Avoid dipping from small bodies of water or waters that are known to contain aquatic diseases.

Helispot Construction. Construction of helispots often results in the felling of trees and snags, which are potential wildlife habitat, especially in the case of snags. In addition, helicopter traffic would likely disturb sensitive wildlife, such as nesting raptors. Impacts of helispots on wildlife is

expected to be minor, adverse, and short- term. Mitigation: Limit helispot construction; site helispots away from sensitive resources; use natural clearings for helispots.

Spike Camps. Fire crews staying in spike camps can have an adverse effect on some wildlife by allowing them access to human food. This will potentially lead to such animals becoming conditioned to human foods, and leading to human- wildlife conflicts. In such cases, animals are often eventually killed to protect human safety. Presence of hand crews in remote areas would also introduce an element of disturbance, which could affect sensitive species, such as nesting raptors. Impacts to wildlife from spike camps is expected to be minor, adverse, and short- term. Mitigation: Locating spike camps away from sensitive resources and providing strict control of availability of food will help minimize these impacts.

Snagging. Snags are probably the most valuable tree- form to wildlife (Brown and Bright 1997), providing cavities and loose bark for nesting and roosting, and food in the form of wood- boring insects. Any holding or line construction action that requires the felling of snags to protect human safety and the integrity of the fire line would potentially effect wildlife by reducing the availability of snags to species such as pileated woodpeckers, northern flying squirrel, and several bat species. Mortality of these and other species would likely occur during felling. The number of snags lost would vary, depending upon factors such as the type and age of tree stand, its history of fire and/or disease or insect infestation, and the intensity of the fire. Impacts to wildlife from snag removal associated with holding and line construction actions would be minor, long- term, and adverse because of the relatively small area that is affected. Mitigation: Minimize impacts by limiting snag removal to those snags identified as a clear threat to human safety and fireline integrity.

Mop- up. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a fire, would cause some mortality of buried organisms by exposing them to heat and flames. Mop- up activities also may cause some localized increases in erosion due to loosening of the soil layer. Such impacts, however, would be localized and affect few species. Impacts of mop- up would, therefore, be negligible, adverse, and short- term. Mitigation: Minimize mop- up activities to areas that are a threat to fireline integrity.

Conclusion

Wildland fire suppression activities will occur for all alternatives, although the size and intensity of wildland fires, as well as the difficulty of controlling wildland fires, will vary between the alternatives. It is anticipated that wildland fires and the associated impacts to wildlife species due to suppression activities will be greatest under Alternative 3 due to the lack of active management of fuels and the likelihood of continuing high intensity wildland fires over time. These high intensity wildland fires generally are larger in size and require more aggressive strategies such as dozer- constructed fireline and numerous retardant drops to ensure containment. Alternatives 2 and 4 will significantly decrease impacts associated with wildland fire suppression over time as both will decrease fuel loadings to levels where wildland fires will burn with significantly lower severity and intensity. Containment of these lower intensity fires can normally be contained without the use of dozers or numerous retardant drops, which have the potential for the greatest impacts to wildlife species and their habitats. Alternative 1 will have impacts greater than Alternatives 2 and 4, but less than Alternative 3.

Catastrophic Fire and its Effects. The primary threat to wildlife resources is the possibility of intense, stand- replacing fires over significant portions of the park due to many years of fire suppression and associated fuel buildup. Such fires likely would greatly change the diversity and abundance of wildlife species in the affected area through wide- scale and significant changes in habitat.

In a mixed- intensity fire regime, that is natural for most forested habitats in the park, patches of stand- replacing fire are important components, leading to habitat heterogeneity through creation of small gaps and openings in the forest canopy. These openings, intermixed over the landscape with areas affected by different fire intensities and histories, allow high wildlife species diversity and ecosystem resilience. Wildlife species endemic to Whiskeytown have existed for thousands of years under the natural fire regime and have developed behavioral and life- history adaptations that allow different species to take advantage of the different habitats that result from fire in spatial and temporal contexts. Under current conditions of abnormally high fuel loading in many forest vegetation types, however, the abnormally intense fires that are likely would lead to habitat homogeneity, and an unnatural assemblage and succession of wildlife species adapted to the altered environment.

Many areas of the park are also now overgrown with dense thickets of young age- class coniferous trees, as a result of logging which occurred over much of the park during the few decades prior to NPS land acquisition. While these conditions present the severe threat of catastrophic fire discussed above, they also affect the abundance and diversity of wildlife species directly by creating unfavorable habitat conditions for some species. For example, dense understory growth may adversely affect habitat quality for northern spotted owls by limiting their access to prey species.

Conclusion

Under Alternative I, achieving target conditions for many habitat types would be unlikely, and, therefore, a high threat of catastrophic fire throughout much of the park would continue or increase indefinitely. In addition, fire suppression actions (e.g., fire line construction, helispots, retardant drops, spike camps), and their accompanying impacts are likely to occur frequently under this alternative, because of the higher risk of large fires that are difficult to suppress. Impacts under Alternative 1 will be major, adverse, and long- term.

Under Alternative III, fuel reduction projects are limited to areas in or near fuel breaks and developed areas. The emphasis for this alternative is on suppressing all fires before major impacts occur. However, given the present fuels situation, during unfavorable weather or in remote areas it is likely that some wildland fires will escape initial suppression activities and catastrophic fires will occur. In addition, fire suppression actions and their accompanying impacts will be greatest under this alternative. Impacts under Alternative III will be major, adverse, and long- term.

Under Alternatives II and IV, aggressive fuel reduction efforts will occur and, over time, the likelihood of large- scale catastrophic fire will be greatly decreased.

Mitigation: No mitigation of this impact is available, except implementation of more aggressive programs to achieve target fuel conditions, as given in the action alternatives.

Fire Management Treatments.

Prescribed Fire. This technique provides the greatest potential to restore suppression- affected wildlife habitat and reduce the threat of catastrophic fire. Historically, park managers have primarily targeted areas near park boundaries to reduce the likelihood of wildland fires burning from the park onto adjacent lands. Prescribed fires are planned to occur under conditions that reduce brush and small trees and consume much of the ground fuels, while limiting mortality of overstory trees. These same conditions typically benefit other resources, including wildlife and habitat, and minimize fire- related impacts to sensitive wildlife resources (e.g., raptor nest sites). High levels of fuel loading in some areas may cause prescribed fires to burn at higher than natural intensities, even when fire prescriptions and management are designed to minimize these effects. As a result, forest gaps, and consumption of large woody debris which provides important habitat for many small mammals and salamanders, may be greater than the natural range of variation in

some areas of a burn. This may adversely affect species that depend on this habitat component. Such impacts, however, must be weighed against the benefit of reduced risk of catastrophic fire that would cause much greater detrimental change in wildlife habitat.

Site Preparation associated with Prescribed Fire (hand line construction, snagging). Hand line construction would result in the removal and disturbance of soil and forest litter, possibly affecting animals such as small mammals, amphibians, invertebrates, and ground- nesting birds. The presence of crews in remote locations could cause direct disturbance of some wildlife species. Impacts can be minimized by on- site avoidance of valuable or sensitive wildlife resources encountered (e.g., raptor nests, and riparian areas). Removal of forest litter and vegetation can lead to soil erosion and increased siltation in adjacent lakes and streams. This could have an adverse effect on aquatic species, such as fish, amphibians and aquatic invertebrates. Snagging, or snag removal along the periphery of a prescribed fire, is completed before ignition to lessen the chances of fires starting across control lines by reducing a source of airborne embers. Snag removal results in a loss of habitat to some wildlife species such as cavity nesters and species that feed on invertebrates typically associated with snags or decaying wood, as well as species that favor snags for dens. This habitat would likely be replaced over time as some new snags will generally be created by the prescribed fire. Mitigation: Careful planning of fire line construction to avoid sensitive wildlife resources and habitats, and avoidance of unnecessary line construction or removal of snags that do not pose a threat to control of the fire.

Mop- up. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a fire, would cause some mortality of buried organisms by exposing them to heat and flames. Mop- up activities also may cause some localized increases in erosion due to loosening of the soil layer. Such impacts, however, would be localized and affect few species. Mitigation: Limit mop- up activities to areas that threaten the integrity of the fireline.

Conclusion

Under Alternative I, approximately 1400 acres per year would be targeted for prescribed burns and benefits would be limited by the relatively small number of acres that would be treated. This is significantly less than the amount believed to have burned naturally each year. Under Alternative 1, impacts of prescribed fire on wildlife would be minor, beneficial, and long- term because this action provides focused movement toward habitat improvement in areas most severely altered by fire suppression. Additionally, there will be some reduction in the risk of catastrophic fire, but such benefits are limited by the relatively small amount of area that would be treated annually. Non- dormant season burning is only done on an extremely limited scale under this alternative. Therefore, impacts to nesting birds and vegetative habitat that is vulnerable to in- season fire will be negligible.

Under Alternative II, approximately 3000 acres per year are planned for prescribed burns. This alternative provides the most long- term benefit for wildlife and also most closely mimics pre- settlement fire acreages within the park. Additionally, short- term adverse impacts associated with site preparation and mop- up will be greatest under Alternative II. Impacts associated with non- dormant season burning will be greatest under this alternative as well, since targeted acreages will likely necessitate significant amounts of in- season prescribed burning. Under Alternative II, short- term impacts will be adverse and minor, while long- term impacts will be beneficial and major.

Under Alternative III, approximately 250 acres per year are targeted for prescribed burns. This alternative provides the least long- term benefits and also has the least short- term impacts. This alternative also does little to diminish the threat of catastrophic wildland fire to wildlife and wildlife habitat. Short- term impacts to wildlife under this alternative will be negligible, while

long- term impacts are adverse and major based on the continued threat of large- scale catastrophic wildland fire.

Under Alternative IV, approximately 2250 acres per year are targeted for prescribed fire. Adverse and beneficial impacts associated with this alternative fall in between those associated with Alternatives I and II.

Level I Mechanical Fuel Treatment. Hand thinning of understory vegetation, down fuels, and small- diameter trees near developed areas, along the boundary, and along shaded fuel breaks would have mixed effects on wildlife and habitat. Thinning of the forest and fuels to target conditions provides a more natural habitat in these areas, and helps reduce the threat of catastrophic fire, especially from human- caused ignitions that typically occur in or near developed areas. The resulting forest structure, however, tends to be less complex and more homogeneous. It is likely that some species will benefit from the increase in openness, particularly in areas of dense chaparral, while others will be adversely affected by the reduction of complexity and structure.

Construction of shaded fuel breaks and hand thinning operations will potentially adversely impact wildlife in a number of ways. Removal of brush and some small trees will adversely affect wildlife currently using these habitat features, such as insects and nesting birds. Also, human presence and use of tools, such as chainsaws, during thinning operations will disturb wildlife, although such disturbance is temporary. Additionally, fuel breaks may contribute to habitat fragmentation for species which require dense understory habitat for movement or dispersal. Disturbance related impacts will be adverse, short- term and minor, while habitat modification related impacts will be adverse, long- term and minor.

In habitats near developed areas, where protection of human- built structures and facilities is a concern, manual thinning and pile burning to reduce fuel loads would potentially result in forest structure that differs significantly from the natural condition. These areas will become more open (less understory vegetation) with less down wood and the localized effect on animal species that depend on these features, such as salamanders, small mammals, and ground- nesting birds will be adverse. Developed areas within the park constitute a relatively small area, and therefore the associated adverse impacts will be minor and long- term.

Pile Burning. Piling and burning of vegetation removed during hand thinning may have an adverse effect on some wildlife. Some species, such as small rodents, ground- nesting birds, and reptiles, may take up residence in burn piles between the time they are stacked and the time they are burned; which sometimes can be several months. Most of these animals are likely to flee the flames once the piles are ignited, but some may perish.

Conclusion

Under Alternative I, approximately 275 acres per year would be impacted by Level 1 mechanical fuel treatments. The area of habitat affected would be relatively small and some wildlife species may be adversely affected by the emphasis on fuel reduction, but other species are likely to benefit from achievement of some reduction of the threat of catastrophic fire. Impacts to wildlife would be minor, adverse, and long- term.

Under Alternative II, Level 1 mechanical treatment would only be used in developed areas, along boundaries, and to prepare existing fuel breaks for use as prescribed burn unit boundaries. Impacts associated with Level 1 mechanical treatment will be negligible.

Under Alternative III, approximately 225 acres per year would be treated by hand- thinning and shaded fuel break construction. Impacts to wildlife would be similar to those occurring under Alternative 1.

Under Alternative IV, approximately 225 acres per year would be treated by hand- thinning and shaded fuel break construction. Impacts to wildlife would be similar to those occurring under Alternatives I and III.

Chipping. Chipping vegetation removed during hand thinning will likely have minor, short- term adverse affects to some wildlife species due to the high levels of noise produced by the chipping machine. Vertebrate species will likely move out of the area during chipping activities. Additionally, accumulation of wood chips will likely inhibit herbaceous species, grasses, and other new plant growth that benefit many species of wildlife. As the wood chips deteriorate, however, important nutrients will be added to the soil and plant production will likely increase. Under all Alternatives, chipping will be used only along roads and in developed areas, thus, impacts will be minor, adverse, and short- term.

Alternative I. No Action (Current Program)

All impacts to wildlife that will occur under Alternative I will also occur under the other alternatives. The primary difference between Alternative I impacts and those associated with the other alternatives is scale. For example, it is likely that those impacts associated with catastrophic wildland fire will occur on a larger- scale under Alternative I than under Alternatives II or IV, due primarily to the pre- fire treatment of fuel/vegetation. Conversely, the adverse impacts associated with pre- fire fuel treatments will occur on a smaller scale for Alternative I than for Alternatives II or IV. See above for comparison of impacts associated with all alternatives.

Cumulative Impacts. Effect of Alternative I on wildlife would be major, adverse, and long- term, based primarily upon the continuation of the direct effects of high- fuel loading on habitat structure and quality in some areas, and the continued threat of catastrophic fire which has the potential to cause wide- scale, long- term, changes in habitats, and result in great changes in wildlife abundance and diversity in those areas affected. Impacts from actions to suppress fires would be occur regularly under this alternative, because of the prolonged period over which undesirable high intensity wildland fires are likely to occur. Large, catastrophic fire would potentially affect large areas of wildlife habitat, which are considered important to the natural integrity of the park.

Alternative II. Prescribed Fire Dominated

All impacts to wildlife that will occur under Alternative IV will also occur under the other alternatives. The primary difference between Alternative IV impacts and those associated with the other alternatives is scale. For example, the impacts associated with prescribed fire will occur on a larger- scale under Alternative IV than under the other alternatives, due to the large- scale use of this treatment to control fuels/vegetation. Conversely, the adverse impacts associated with other fuel treatments will occur on a smaller scale for Alternative IV than for the other alternatives. See above for comparison of impacts associated with all alternatives.

Cumulative Impacts. The cumulative impacts of Alternative II on wildlife would be major, beneficial, and long- term, based primarily upon the ability to return fire to the majority of the park with a return interval approaching that thought to occur prior to European settlement. Wildlife native to this area has evolved with the regular occurrence of fire and most habitats of the area benefit from low- severity fire. Short- term adverse impacts associated with the preparation and completion of prescribed fire will likely be offset by the benefits.

Alternative III. Suppression Dominated

All impacts to wildlife that will occur under Alternative III, with the exception of Level 2 mechanical fuel treatment, will also occur under the other alternatives. The primary difference between Alternative III impacts and those associated with the other alternatives is scale and the addition of Level 2 mechanical fuel treatment. See above for comparison of impacts associated with all alternatives.

Level 2 Mechanical Fuel Treatment. Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three- year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. Approximately 225 acres per year are targeted for treatment. Short-term impacts to wildlife associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Vertebrate species will likely leave the area during periods of machine activity. Disturbances to some nesting species will also likely occur during summer periods. Short- term impacts will be adverse and minor. Long- term impacts include changes in habitat structure that will favor some species while reducing habitat suitability for others. Habitat fragmentation is also a potential impact as treated areas may impair movement or dispersal among species that require the dense understory that will be decreased by this treatment. Machinery use associated with this treatment will also potentially increase erosion and the resultant siltation due to loosened soils. Aquatic dependent species, such as amphibians, will potentially be negatively impacted by this treatment. Adverse long- term impacts due to habitat modification will likely be minor. Decrease of the potential for large- scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long- term beneficial impact. Mitigation: Avoidance of areas where sensitive wildlife, such as raptors, are nesting and avoiding steep slopes or easily erodible soils will help minimize impacts to wildlife associated with level 2 mechanical fuel treatment.

Cumulative Impacts. Cumulative effect of Alternative III on wildlife would be major, adverse, and long- term, based primarily upon the continuation of the direct effects of high- fuel loading on habitat structure and quality in some areas, and the continued threat of catastrophic fire which has the potential to cause wide- scale, long- term, changes in habitats, and result in great changes in wildlife abundance and diversity in those areas affected. Impacts from actions to suppress fires would be most intense under this alternative, because of the prolonged period over which undesirable high intensity wildland fires are likely to occur. Large, catastrophic fire would potentially affect large areas of wildlife habitat, which are considered important to the natural integrity of the park.

Alternative IV. Multiple Strategy Program (Preferred Alternative)

Alternative IV utilizes a variety of strategies to reduce fuels to manageable levels. Treatments and impacts unique to Alternative IV include Level 3 Mechanical Fuel Treatment and Wildland Fire Use. A discussion of the impacts to wildlife associated with the strategies and activities occurring under all alternatives are analyzed above with comparisons between the four considered alternatives.

Level 2 Mechanical Fuel Treatment. Impacts will be the similar to those occurring under Alternative III, although approximately 100 additional acres will be targeted per year.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small- diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species

composition representative of pre- settlement, pre- suppression forest conditions. Approximately 300 acres per year will be targeted for this treatment under Alternative IV. Impacts to wildlife species would likely be short- term and adverse, primarily due to disturbance from noise associated with the machinery. Some direct mortality would likely occur for species unable to leave the area. Machinery use associated with this treatment will also potentially increase erosion and the resultant siltation due to loosened soils. Aquatic dependent species, such as amphibians, will potentially be negatively impacted by this treatment. Adverse long- term impacts due to habitat modification will likely be minor. Decrease of the potential for large- scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long- term beneficial impact. Mitigation: Avoidance of areas where sensitive wildlife, such as raptors, are nesting and avoiding steep slopes or easily erodable soils will help minimize impacts to wildlife associated with level 3 mechanical fuel treatment.

Wildland Fire Use. Impacts associated with wildland fire use will be similar to those that would occur due to prescribed fire, although the adverse impacts associated with preparation of prescribed fire boundaries would not occur. Short- term impacts associated with wildland fire use will be minor and adverse. Long- term impacts associated with wildland fire use will be minor and beneficial. Impacts, both beneficial and adverse, will be minor due to the limited acreage (250 acres or less per year) that will be treated.

Cumulative Impacts. Cumulative effect of Alternative IV on wildlife would be moderate, beneficial, and long- term, based primarily upon the ability to decrease the risk of catastrophic wildland fire over time combined with the return of fire to much of the park. Short- term adverse impacts associated with mechanical fuel treatments and prescribed fire preparation will somewhat offset the benefits to wildlife and their habitat.

Species of Special Concern – Animals *Federal Threatened Species*

Bald Eagle (*Haliaeetus leucocephalus*)

Whiskeytown Lake supports two breeding pair of bald eagles as well as a substantial migratory wintering population. Bald eagle activity such as perching, foraging, nesting, and roosting is generally limited to the lower elevations of the park and occurs mostly within two miles of Whiskeytown Lake. Bald eagles are dependent on large, dominant trees for nesting and perching. The majority of foraging activity occurs on Whiskeytown Lake and prey species include a wide variety of fish as well as numerous ducks, coots, and grebes.

Potential for Catastrophic Fire, and its Effects. Bald eagle habitat at Whiskeytown occurs in areas where most fires have been successfully suppressed for several decades. Therefore, a substantial portion of the park's bald eagle habitat is at risk from catastrophic fire. Compounding this threat is the fact that most visitor activity and opportunity for human- caused fire starts occur in close proximity to bald eagle habitat. The relatively slow pace at which this risk would be reduced under Alternatives I and III, through prescribed fire and level I mechanical fuel reduction techniques, means that this risk would continue indefinitely, or potentially grow worse as fuels continue to accumulate. Catastrophic fire would destroy large trees and snags that are important components of bald eagle habitat. Effects of catastrophic fire on bald eagles under Alternatives I and III would potentially be major, adverse, and long- term. Effects of catastrophic fire on bald eagles under Alternatives II and IV would be substantially decreased over time and would likely be moderate, adverse, and long- term.

Fire Management Treatments.

Prescribed Fire. Significant areas of bald eagle habitat occur in the Frontcountry Fire Management Unit (FMU- 1) and the Backcountry Fire Management Unit (FMU- 2). Historic and current nest sites also occur within both FMU's. Under Alternatives I, II, and IV, prescribed fire is proposed to be utilized throughout much of the area around Whiskeytown Lake, which is typically utilized for nesting, roosting, foraging, and perching. Prescribed fire, therefore would be the primary tool for fuel reduction and restoration of natural forest structure in a substantial portion of the park's bald eagle habitat. These areas are also typified by having high fuel loads and abundant ladder fuels. Under Alternative I, however, the rate of prescribed fire use would remain relatively low, so the high risk of catastrophic fire would continue indefinitely. The current high levels of fuel accumulation may, in some areas, result in prescribed fires with enough intensity to cause mortality among some large trees. This adverse effect, however, must be weighed against the reduced threat of catastrophic fire over large areas that would result from prescribed fire use. Helicopter use within ½ mile of bald eagle nest sites will also have the potential impact of disturbance with possible nest abandonment. To mitigate this potential adverse impact, helicopter use will not be allowed within ½ mile of active bald eagle nest sites. Consultation with USFWS, Under Section 7 of the ESA, will be initiated for prescribed fire projects implemented in current or historical bald eagle nesting habitat. Impacts of prescribed fire on bald eagles under Alternatives I, II, and IV would be minor, beneficial, and long- term. Impacts of prescribed fire to bald eagles under Alternative III will be negligible.

Site preparation Associated with Prescribed Fire (handline construction, snagging). Construction of hand lines could have an adverse effect on bald eagles if large trees or snags are cut in areas used by eagles. This would generally not occur, since the management goals include retaining of large trees and hand lines could avoid these features. Some snags would be lost in fires, but new snags would be created from fire mortality of trees. Chain saw use within ½ mile of active nest sites during fireline construction could have an adverse impact on nesting bald eagles due to disturbance and possible nest abandonment. To mitigate this potential adverse impact, fireline construction for prescribed burns will not occur within ½ mile of bald eagle nest sites during the nesting period. Snagging would have an adverse effect on eagles if important perching or roosting snags were cut. However, snags would only be cut if they presented a threat to life and safety, were a threat to control of a prescribed fire, or represented a hazard to property or park resources. Impacts of site preparation associated with prescribed fire under Alternatives I and IV would be minor, adverse, and short term. Impacts of site preparation associated with Alternative II would be increased but would still be classified as minor, adverse, and short- term. Impacts of site preparation under Alternative III would be negligible.

Mopup. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to bald eagles, although some potential exists for disturbance of perched or foraging eagles. Impacts of mop- up under all alternatives would be negligible, adverse, and short- term.

Level 1 Mechanical Fuel Treatment. Chain saw use associated with thinning and fuel break construction could potentially cause disturbance of nesting bald eagles if allowed to occur within ½ mile of active nests. To avoid this impact, chainsaw use would not occur within ½ mile of active nest sites. Thinning and shaded fuel break construction would have an indirect benefit to bald eagles by lessening severity and size of wildland fire and therefore, reducing mortality to large trees and fire consumption of snags. Human activity associated with pile burning may adversely impact foraging or perched eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts to bald eagles of Level 1 Mechanical Fuel Treatments would be minor, beneficial, and long term under Alternatives I, III, and IV. Impacts to bald eagles associated with Level 1 Mechanical Fuel Treatment under Alternative II would not occur.

Pile burning. Activities associated with pile burning could cause disturbance to nesting bald eagles if allowed to occur in the immediate vicinity of active bald eagle nests. To mitigate this potential impact, pile burning would not occur near active bald eagle nests. Human activity associated with pile burning may adversely impact foraging or perching eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts of pile burning would be minor, adverse, and short term under all alternatives.

Chipping. High noise levels associated with chipping vegetation would potentially cause disturbance to nesting bald eagles if allowed to occur within ½ mile of active bald eagle nests. To mitigate this potential impact, chipping activities would be limited to areas outside bald eagle nest sites or to periods when nesting activity is not occurring. Human activity associated with pile burning may adversely impact foraging or perching eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts of chipping would be minor, adverse, and short term under all alternatives.

Wildland Fire Suppression. Construction of hand lines or dozer lines associated with wildland fire suppression activities would have an adverse effect on bald eagles if large trees or snags are cut or pushed over in areas used by eagles. This would generally not occur, since management goals include retaining of large trees and containment lines could avoid these features. Water or retardant drops could have an adverse effect on eagles if nesting birds are disturbed by aircraft. To mitigate this potential adverse impact, aircraft use will not be allowed within 1/2 mile of active bald eagle nest sites. Helispots would generally be constructed in open areas away from the large trees favored by eagles. Snagging would have an adverse effect on eagles if important perching or roosting snags were cut. However, snags would only be cut if they presented a threat to life and safety, were a threat to control of a wildland fire, or represented a hazard to property or park resources. Emergency consultation with USFWS, under Section 7 of the Endangered Species Act, would be initiated in the event of a wildland fire occurring within ½ mile of nesting habitat or if nesting habitat is under imminent threat of being impacted by fire or suppression activities. Impacts of wildland fire suppression activities to bald eagles would potentially be high initially under all alternatives, but would be lessened over time under Alternatives II and IV which call for more aggressive treatment of hazardous fuels. Impacts due to fire suppression activities are likely to be minor, adverse, and short- term for all alternatives.

Level 2 Mechanical Fuel Treatment. Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three- year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. This treatment will only be used under Alternatives III and IV. Approximately 225 acres/year are targeted for treatment under Alternative III and approximately 320 acres/year under Alternative IV. Potential short- term impacts to bald eagles associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Decrease of the potential for large- scale catastrophic wildland fire and resultant mortality of large overstory trees is a moderate, long- term, beneficial impact. Short- term impacts to bald eagles associated with Level 2 Mechanical Fuel Treatment will be minor and adverse for Alternatives III and IV. Long- term impacts to bald eagles associated with Level 2 Mechanical Fuel Treatments will be moderate and beneficial for Alternatives III and IV.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small- diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species

composition representative of pre- settlement, pre- suppression forest conditions. This treatment would only be used under Alternative IV and would treat approximately 300 acres/year. Potential short- term adverse impacts to bald eagles would be primarily due to disturbance from noise associated with the machinery. This impact will likely be minor as machinery will not be used within ½ mile of nesting bald eagles and foraging areas around Whiskeytown Lake are not targeted for this treatment. A potential beneficial impact is that thinning overstocked stands will likely improve growth of remaining trees and potentially provide stands of large conifers used by eagles for nesting. Decrease of the potential for large- scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long- term beneficial impact.

Wildland Fire Use. Wildland Fire Use would only be used under Alternative IV. Impacts associated with wildland fire use will be similar to those that would occur due to prescribed fire, although the adverse impacts associated with preparation of prescribed fire boundaries would not occur. Short- term impacts associated with wildland fire use will be minor and adverse. Long- term impacts associated with wildland fire use will be minor and beneficial. Impacts, both beneficial and adverse, will be minor due to the limited acreage (250 acres or less per year) that will be treated.

Conclusion. Alternatives I and III would have a moderate, adverse, long- term effect on bald eagles, primarily based on the continued threat of catastrophic fire, that would affect the large trees and snags that are important habitat components. Alternatives II and IV will significantly decrease the major threat of catastrophic wildland fire to bald eagle habitat over time through aggressive treatment of fuels. Alternative IV will have more potential to have adverse impacts to bald eagles from disturbance, both from human activity and from machinery noise. These impacts may be minimized by avoidance of areas used for nesting, foraging, or roosting.

Northern Spotted Owl (*Strix occidentalis caurina*)

The northern spotted owl is found throughout much of northern California in dense old- growth, multi- layered mixed conifer, redwood, and Douglas- fir habitats, from sea level up to approximately 7600 ft. (Zeiner et al. 1990). The western area of the park falls within the reported range of the northern spotted owl and contains some areas of suitable habitat. Forested areas with greater than 70% canopy closure are potential spotted owl nesting and roosting areas, while areas with greater than 40% canopy closure provide foraging areas. Old growth forests provide the best habitat. Most spotted owl habitat owes its structure and species composition to fire (Lujan 1992). Historically, spotted owls occupied a dynamic landscape that often consisted of large areas of burned and unburned forest. Today, however, habitat is greatly reduced and fragmented, and owl populations have become increasingly vulnerable to loss of habitat due to fire (Lujan 1992). Fires can cause further habitat fragmentation and loss of preferred suitable old growth. One study showed that areas that had been clearcut or burned within the previous 20 years were rarely used by spotted owls for foraging. Additionally, spotted owls usually avoided crossing burned areas by traveling through corridors of unburned timber around the area.

Spotted owls are also intolerant of high temperatures and are stressed at temperatures above 80 to 87 degrees Fahrenheit (27- 31 deg. C) (Gutierrez 1985). Spotted owls tend to roost in small trees in the forest understory during warm weather and high up in the large trees during cold or wet weather. The layered canopy structure in old forests provide both types of roosts. (Thomas et. al. 1990). There is one known spotted owl site within the park, but more sites may be found as surveys are completed in some of the more remote areas of the park. Much of the higher elevations along the western boundary of the park that historically may have supported spotted owls was heavily altered by timber harvest activities in the 1960's and early 1970's. It is possible that these areas will be repopulated by spotted owls as the forest regenerates, matures and develops the complex structural characteristics commonly found in areas occupied by spotted owls.

Potential for Catastrophic Fire, and its Effects. Under a natural fire regime, much of the spotted owl habitat in the Klamath Mountains was subject to frequent, low- intensity fires. Under current conditions, most of the area considered suitable spotted owl habitat, has not burned for many decades. These areas are typically characterized by unnaturally high fuel loads with extensive ladder fuels in the form of thick brush stands or white fir regeneration. These conditions make it likely that large, stand- replacing fires will occur, which would destroy spotted owl habitat by reducing the canopy closure and multi- level forest that defines good habitat. In addition, the growth of dense understory vegetation may affect habitat quality by making foraging by spotted owls more difficult. Under Alternatives I and III, the relatively slow rate of treatment of forest habitats to reduce fuel accumulations would likely result in the destruction of spotted owl habitat through catastrophic fires and prolong the degradation of habitat by allowing thick understory vegetation to remain. Impact of catastrophic fire on northern spotted owls under Alternatives I and III would be major, adverse, and long- term. Effects of catastrophic fire on northern spotted owls under Alternatives II and IV would be substantially decreased over time and would likely be moderate, adverse, and long- term.

Fire Management Treatments.

Prescribed Fire. Prescribed fire provides the greatest potential for targeted treatment of forest habitats, with a focus on protecting spotted owls and improving their habitat. Additional preparation work will be performed on prescribed fires that include known spotted owl nesting territories. This prep work would include scattering of heavy fuel build- up near large conifers and manual removal of ladder fuels near large trees. Prep work and prescribed burns would only be completed outside the Limited Operating Period (LOP), which currently is Feb. 1 – July 10. The additional prep work is designed to reduce the chance of adverse effect on nesting and roosting habitat from high- intensity fire. Additionally, Consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to initiation of prep work or implementation of the burn. Prescribed fire must also take into account other habitat components, such as large, down, woody debris which are known to be important to prey species of spotted owls. Fires of an intensity that would significantly reduce the amount of large, woody debris would, therefore, have an adverse effect on spotted owls. The use of prescribed fire under Alternatives I, II, and IV would have minor, adverse, short- term impacts and minor, beneficial, long- term impacts on northern spotted owls, primarily through reduction of the threat of catastrophic fire. Prescribed fire would not be used within northern spotted owl habitat under Alternative III.

Site Preparation Associated with Prescribed Fire (handline construction, snagging). Disturbance associated with chainsaw use during handline construction would potentially adversely affect spotted owls if it occurred near a nest site during the nesting season. To avoid this impact, handline construction would not occur within ¼ mile of a known owl nest site during the LOP. Additionally, removal of overstory trees during handline construction will be avoided. Snags are often used by spotted owls as nest sites. Therefore, snagging operations would only occur to ensure health and human safety and the integrity of fire lines. Site preparation associated with prescribed fire would have negligible, adverse, short- term impacts on the northern spotted owl under Alternatives I, II, and IV.

Mopup. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to spotted owls, although some potential exists for disturbance of roosting owls. Impacts of mop- up would be negligible, adverse, and short- term under Alternatives I, II, and IV.

Level 1 Mechanical Fuel Treatment. Level 1 mechanical fuel treatment is not proposed to occur in suitable northern spotted owl habitat under any of the alternatives.

Wildland Fire Suppression. Water and retardant drops would have an adverse effect on spotted owls if they occurred over nesting habitat, and affected nests. Such events have a low probability of occurring, but could be mitigated if nest sites and probable nesting habitat could be avoided. Helispots and spike camps would potentially have an adverse effect on spotted owls if they were located close to nesting or roosting areas, and the level of disturbance associated with these areas was high. Hand- line, if constructed through a spotted owl nesting or roosting area would potentially cause adverse effects from disturbance and habitat alteration, especially if trees were felled. Emergency consultation with USFWS, under Section 7 of the Endangered Species Act, would be initiated in the event that a wildland fire or wildland fire suppression activities threatens suitable spotted owl nesting habitat. Impacts to the northern spotted owl from wildland fire suppression would be moderate, adverse, and short- term under all alternatives, although these impacts are expected to occur most frequently under Alternatives III and I.

Level 2 Mechanical Fuel Treatment. Level 2 Mechanical Fuel Treatment is not planned to occur in spotted owl habitat.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment is not planned to occur in spotted owl habitat.

Wildland Fire Use. This treatment is only considered under Alternative IV and would likely impact less than 250 acres/year. Impacts to spotted owls and their habitat will be similar to prescribed fire with short- term adverse impacts and long- term beneficial impacts.

Conclusion. Alternatives I and III would potentially have major, adverse, long- term impacts on spotted owls from the prolonged threat of catastrophic fire that would be likely due to the current, relatively slow rate of treatment of accumulated fuels. Alternatives II and IV would effectively decrease the threat of catastrophic fire to spotted owl habitat over time. Short- term impacts under Alternatives II and IV would be minor and adverse, while long- term impacts would be moderate and beneficial.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

Presence of the valley elderberry longhorn beetle (VELB) has not been documented within the park, but may occur along some portions of Clear Creek. The entire life cycle of the VELB is connected to the elderberry plant (*Sambucus sp.*). A small population of elderberry plants have been documented within the park near Trinity Mountain Road, ½ mile south of French Gulch. The entire park has not been surveyed for elderberry plants and it is possible that other small populations may be discovered. It is unknown if VELB are present on the Elderberry plants known to occur within the park as very dense Himalayan blackberry presently prevents examination of stems for exit holes. The nearest confirmed VELB occurrences were near Turtle Bay in Redding about 15 miles east of the park elderberry location (California Natural Diversity Database).

Adverse impacts to elderberry plants could have an adverse effect on VELB. Management activities such as prescribed fire, mechanical fuel treatment, and wildland fire suppression generally have goals of protecting riparian areas and impacts to elderberry bushes that occur in these areas would be nonexistent or negligible. There are no plans to implement fire or fuel management related projects in the immediate vicinity of the known population of elderberry plants. Consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to implementation of any project activity that may affect elderberry plants.

Conclusion: All alternatives will have a negligible impact on the valley elderberry longhorn beetle.

California red- legged frog (*Rana aurora draytonii*)

The park falls within the reported range of the California red- legged frog, and some suitable habitat exists (ponds and slow- moving streams with emergent vegetation), but no historic observations of the species are known from the park. The nearest known population of red- legged frogs is in Tehama County, approximately 35 miles south of the park. Surveys of areas containing suitable habitat were completed in 1995 and adults, tadpoles, and egg masses were not located. Additionally, all potential suitable habitat within the park is currently occupied by non- native bullfrogs which generally exclude red- legged frogs. It is unlikely that activities associated with fire or fuel management activities will have any impact on the California red- legged frog. If red- legged frogs are located within the park, consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to implementation of any project activity that may affect the California red- legged frog.

Conclusion: The California red- legged frog will not be impacted by any of the alternatives.

Federal Species of Concern

Pacific Fisher (*Martes pennanti pacifica*)

Fishers are among the most habitat- specific mammals in North America, living in landscape mosaics of conifer- dominated forest stands, and avoiding open areas that have no overstory or shrub cover (Buskirk and Powell 1994). Late successional mid to low elevation coniferous or mixed forests provide the most suitable habitat because they provide abundant potential den sites and prey (Allen 1983). The presence of large deciduous trees, such as oaks, also appears to be important. Fishers den in a variety of protected cavities, brush piles, logs, or under an upturned tree. Hollow logs, trees, and snags are especially important habitat components (Zeiner et al. 1988). Forest type is probably not as important to fishers as structural characteristics, such as dense canopies, and large trees, snags, and down logs. Riparian areas are also important (Seglund 1995). Fishers may be extirpated from much of their historical range in Washington, Oregon, and California (Zielinski et al. 1995). Trapping at the end of the 19th century severely reduced fisher populations, but the reasons for the lack of recovery in the species in the absence of trapping are unclear. Factors may include loss of suitable habitat from logging and fire suppression, fragmentation of habitat, and disturbance and mortality from roads. Distribution and populations of fishers are not known at Whiskeytown, but the Wildlife Observation Database, dating from the early 1970's to present, reports numerous fisher observations throughout many areas of the park. It is likely that fishers occur at Whiskeytown where suitable habitat exists.

Potential for Catastrophic Fire, and its Effects. Catastrophic fire has the potential for severely altering fisher habitat by reducing canopy closure and forest floor features that are important components of suitable fisher habitat. Many areas of the park that contain suitable fisher habitat have not burned for several decades and are characterized by having high levels of down fuel and considerable ladder fuels in the form of brush and conifer seedlings. The potential for catastrophic fire and the resultant adverse impacts to fisher habitat is high in these areas. Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of catastrophic fires and adverse effects on fishers. Impacts of Alternatives I and III on fishers would, therefore, be major, adverse, and long- term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Fire Management Treatments.

Prescribed Fire. Because prescribed fires can be targeted on habitats that are at the greatest risk of catastrophic fire, and are the most severely altered by a history of fire suppression, it has the potential for great resource benefit.

High fuel loadings in some areas would potentially result in prescribed fires of high enough intensity to consume large woody debris, which is an important component of fisher habitat. Also, large snags, which are of high value to fishers, would potentially be consumed. This impact will be offset somewhat by the likelihood that the prescribed fire will create some new snags. Short- term impacts of prescribed fire will be minor and adverse. Long- term impacts will be minor and beneficial due to the reduction of the risk of catastrophic fire. Burn prescriptions should strive to conserve habitat elements that are important to fishers. The benefit of prescribed fire under Alternative I would be limited by the relatively slow rate of its use. Therefore, impacts to fisher under Alternative I would be minor, beneficial, and long- term, based upon a modest reduction in the threat of catastrophic fire. Under Alternative II, prescribed fire use would approximately double over current levels and the associated impacts, both adverse and beneficial, would also approximately double. Under Alternative III, prescribed fire would only be used on an extremely limited basis and impacts would be negligible. Under Alternative IV, use of prescribed fire would increase slightly over current levels, and impacts would be comparable to Alternative I.

Site Preparation Associated with Prescribed Fire (handline construction, snagging). Disturbance associated with chainsaw use during handline construction may potentially adversely affect denning fishers. Additionally, handline construction has the potential to expose dens hidden by dense brush. Removal of overstory trees during handline construction will be avoided. Snags will only be cut to ensure health and human safety and the integrity of fire lines. Under Alternative I, site preparation associated with prescribed fire would have minor, adverse, short- term impacts on the pacific fisher. These impacts would approximately double under Alternative II, but would likely still remain minor, adverse, and short- term. Impacts to fishers resulting from site preparation for prescribed fires under Alternative III would be negligible. Prescribed fire preparation impacts resulting from Alternative IV would be similar to Alternative I.

Mopup. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to fishers under all alternatives. Impacts would be short- term, negligible and adverse.

Level 1 Mechanical Fuel Treatment. Chain saw use associated with thinning and fuel break construction could potentially cause disturbance of denning fishers. Fishers prefer dense forest stands and thinning and fuel break construction will likely degrade portions of their habitat. These impacts will be minor, adverse and long- term. Thinning and shaded fuel break construction would have an indirect benefit to fishers by lessening severity and size of wildland fire and therefore, reducing mortality to large trees and fire consumption of snags. Human activity associated with pile burning may adversely impact fishers by causing them to temporarily move out of preferred areas. Short –term impacts of Level 1 Mechanical Fuel Treatments would be minor and adverse. Long- term impacts would be minor and beneficial.

Pile burning. Human activity associated with pile burning may adversely impact foraging or denning fishers by causing them to temporarily move out of preferred areas. Fishers have been documented to use brush piles for denning and shelter and it is possible, but not likely, that denning sites would be established in newly created brush piles and then destroyed during pile burning activities. This impact is not likely as most brush piles are burned as soon as conditions allow this to safely occur. Impacts to fishers associated with pile burning under all alternatives would be negligible, adverse, and short term.

Chipping. High noise levels associated with chipping vegetation would potentially cause disturbance to denning or foraging fishers. Human activity associated with chipping may adversely impact foraging fishers by causing them to temporarily move out of preferred areas. This is unlikely to occur as chipping activities will only occur along roads or near developed areas that are normally avoided by fishers. Impacts to fishers from chipping would be negligible, adverse, and short term under all alternatives.

Wildland Fire Suppression. Handline and dozerline construction could have a localized, adverse effect on fishers through direct disturbance, and alteration of habitat. Such effects, however, would be limited in area and short- term. Water and retardant drops would likely have no effect on fishers. Some short- term disturbance would occur from helicopter or airplane overflights. Helispot and spike camps could have an adverse effect if they were located near a fisher den. This impact could not be avoided due to lack of information on den sites. Snagging could have an adverse effect on fishers by removing an important habitat component, because snags are often used as den sites. Snags should only be cut when they present a clear threat to human safety or the integrity of a fire line. Prescribed and wildland fire would create new snags through the killing of trees, but it would take time for the dead trees to become suitable snags through decay. Overall, actions taken to suppress wildland fires would likely have a minor, adverse, long- term effect on fishers under all alternatives, primarily due to possible reduction in the number of snags and small- scale habitat alteration.

Level 2 Mechanical Fuel Treatment. Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three- year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. This treatment will only be used under Alternatives III and IV. Approximately 225 acres/year are targeted for treatment under Alternative III and approximately 320 acres/year under Alternative IV. Potential short- term impacts to fishers associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Decrease of the potential for large- scale catastrophic wildland fire is a moderate, long- term, beneficial impact. Short- term impacts to fishers associated with Level 2 Mechanical Fuel Treatment will be minor and adverse.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small- diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species composition representative of pre- settlement, pre- suppression forest conditions. This treatment would only be used under Alternative IV and would treat approximately 300 acres/year. Potential short- term adverse impacts to fishers would be primarily due to disturbance from noise associated with the machinery. This impact will likely be minor as the area targeted for treatment is relatively small. Decrease of the potential for large- scale catastrophic wildland fire and resultant habitat destruction is a moderate long- term beneficial impact.

Wildland Fire Use. Wildland Fire Use would only be used under Alternative IV. Impacts associated with wildland fire use will be similar to those that would occur due to prescribed fire, although the adverse impacts associated with preparation of prescribed fire boundaries would not occur. Short- term impacts associated with wildland fire use will be minor and adverse. Long- term impacts associated with wildland fire use will be minor and beneficial. Impacts, both

beneficial and adverse, will be minor due to the limited acreage (250 acres or less per year) that will be treated.

Conclusion: Overall, Alternatives I and III would have a major, adverse, long- term effect on fishers by allowing the threat of catastrophic fire to continue indefinitely. Alternatives II and IV will have short- term, adverse impacts associated with disturbance, while providing long- term, beneficial impacts through the aggressive treatment of fuels and reduction of the likelihood of catastrophic wildland fire and habitat loss.

Foothill yellow- legged frog (*Rana boylei*)

Foothill yellow- legged frogs are dependent on permanent water and are found in or near rocky streams in a variety of habitats, including mixed chaparral, valley- foothill hardwood, valley- foothill hardwood conifer, ponderosa pine, mixed conifer, and wet meadow types (Zeiner et al. 1988). Unlike most other ranid frogs in California, this species is rarely encountered far from permanent water (Zeiner et al. 1988). Exotic bullfrogs (*Rana catesbeiana*), which are prevalent at Whiskeytown, have been implicated in the observed reduction of foothill yellow- legged frog populations in the Sierra (Moyle 1973). Foothill yellow- legged frogs are fairly common in the perennial streams that feed Whiskeytown Reservoir.

Potential for Catastrophic Fire, and its Effects. Catastrophic wildland fire could potentially alter habitats important to foothill yellow- legged frogs. The most likely scenario would be that a catastrophic wildland fire could consume large amounts of riparian habitats, which are important to frogs. A secondary impact would be the increases in sedimentation of streams that is likely to significantly increase following catastrophic fire. Increases in sedimentation will adversely impact egg masses, tadpoles, and adults. Impacts from catastrophic fire on foothill yellow- legged frogs would be moderate, adverse, and long- term, based primarily on the loss of riparian habitats and sedimentation of aquatic habitats.

Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of catastrophic fires and adverse effects on foothill yellow- legged frogs. Impacts of Alternatives I and III on foothill yellow- legged frogs would, therefore, be major, adverse, and long- term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Fire Management Treatments.

Prescribed Fire. Although prescribed fire would be limited under Alternative I, some benefit to foothill yellow- legged frogs would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation. Negligible increases in sedimentation to streams may occur post- fire due to exposed soil along control lines. Portable pumps are often placed in streams during prescribed fires and the risk for fuel spills into the stream is present. Fuel spills into the stream would have a moderate, adverse, short- term impact to foothill yellow- legged frogs. Overall impacts of prescribed fire on foothill yellow- legged frogs under Alternative I would be negligible, beneficial, and long- term due to the reduction of risk of catastrophic wildland fire. Impacts, both adverse and beneficial, to foothill yellow- legged frogs would be greatest under Alternative II, which would approximately double the level of annual prescribed fire acreage. Prescribed burning will only occur at a minimal level under Alternative III and impacts will be negligible. Impacts on foothill yellow- legged frogs associated with prescribed fire under Alternative IV will be similar to Alternative 1.

Site Preparation Associated With Prescribed Fire (handline construction, snagging). Handline construction will expose soil and may result in post- fire increases in sedimentation to waterways.

Snagging is not likely to have impacts to foothill yellow- legged frogs. Impacts associated with prescribed fire site preparation is minor, adverse, and short- term under Alternatives I and IV. Impacts under Alternative III is negligible. Impacts to foothill yellow- legged frogs from prescribed fire site preparation under Alternative II will be greatest and will likely be moderate, adverse, and short- term, based on the increase in targeted acreage and associated line construction and sedimentation.

Mopup. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would potentially cause increases in erosion and sedimentation of streams. This impact would likely be localized and fairly small in scope as most hot- spots that require active mop- up will occur upslope and away from riparian areas and streams. Impacts associated with mop- up will be minor, adverse, and short- term for Alternatives I, III, and IV. Impacts associated with Alternative II will be negligible.

Level 1 Mechanical Fuel Treatment. Thinning and shaded fuel break construction would have an indirect benefit to foothill yellow- legged frogs by lessening severity and size of wildland fire and therefore, reducing impacts to riparian areas and sedimentation of streams. Human activity associated with thinning and shaded fuel break construction may adversely impact frogs by causing increases in erosion and sedimentation of streams. Short -term impacts of Level 1 Mechanical Fuel Treatments from Alternatives I, III and IV would be minor and adverse. Long-term impacts from Alternatives I, III and IV would be minor and beneficial. Impacts resulting from Level 1 Mechanical Fuel Treatment under Alternative II will be negligible.

Pile burning. Pile burning will not likely impact foothill yellow- legged frogs.

Chipping. Chipping is not likely to impact foothill yellow- legged frogs.

Wildland Fire Suppression. Retardant drops could adversely affect foothill yellow- legged frogs through contamination of their aquatic habitat. Protocols for retardant use at Whiskeytown restrict its use within 300 feet of water, which lessens the chances of the chemicals reaching water. Nevertheless, it is likely that some chemicals from retardant use will flush into streams during rains. Impacts of retardant use on foothill yellow- legged frogs are potentially moderate, adverse, and short- term based primarily on the possibility of accidental retardant contamination of streams. Water drops will not likely have an impact on the foothill yellow- legged frog. These impacts will likely be similar for all alternatives as fire suppression strategies at Whiskeytown rely on aggressive initial attack with airtankers and helicopters during periods of high fire risk, regardless of fire size.

Helispots and spike camps would have limited use in yellow- legged frog habitat, and would be sited away from such sensitive habitats. Hand and dozer lines would have potential impacts from the resultant sedimentation of streams that would occur due to the disturbed, exposed topsoil. Hand and dozerlines often travel straight up slopes and provide excellent corridors for water diversion and erosion. These impacts can be minimized by avoiding the use of dozers where possible and rehabilitating firelines after the fire is contained/controlled. Overall impacts of wildland fire suppression actions on yellow- legged frogs under Alternatives II and IV would be minor, adverse, and long- term due to the aggressive treatment of fuels and accompanying decrease in wildland fire severity and likelihood of more rapid containment and control. Impacts resulting from wildland fire suppression under Alternative III will likely be more severe as the probability of large, intense fires requiring multiple retardant drops and dozer lines is higher. Impacts under Alternative I are less than Alternative III and more than Alternatives II and IV.

Level 2 Mechanical Fuel Treatment. Level 2 mechanical fuel treatment involves the use of brush- reduction machinery to grind and shred brush on a three- year review cycle to determine

maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. Erosion and sedimentation will be minimized by restricting this treatment to slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. This treatment will only be used under Alternatives III and IV. Approximately 225 acres/year are targeted for treatment under Alternative 3 and approximately 320 acres/year under Alternative IV. Adverse impacts to foothill yellow- legged frogs from Level 2 Mechanical Fuel Treatment will be negligible as treatments are restricted to areas away from riparian zones or perennial streams. Decrease of the potential for large- scale catastrophic wildland fire is a moderate, long- term, beneficial impact.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small- diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species composition representative of pre- settlement, pre- suppression forest conditions. This treatment would only be used under Alternative IV and would treat approximately 300 acres/year. Potential short- term adverse impacts to foothill yellow- legged frogs will be erosion and sedimentation resulting from machinery use. This impact will likely be minor as the area targeted for treatment is relatively small and will not occur within riparian zones or near perennial streams. Decrease of the potential for large- scale catastrophic wildland fire and resultant habitat destruction is a moderate, long- term beneficial impact.

Wildland Fire Use. Wildland Fire Use would only be used under Alternative IV. Impacts associated with wildland fire use will be similar to those that would occur due to prescribed fire, although the adverse impacts associated with preparation of prescribed fire boundaries would not occur. Short- term impacts associated with wildland fire use will be minor and adverse. Long- term impacts associated with wildland fire use will be minor and beneficial. Impacts, both beneficial and adverse, will be minor due to the limited acreage (250 acres or less per year) that will be treated.

Conclusion. Impacts to foothill yellow- legged frogs from Alternatives I and III will be minor, adverse, and long- term based on the continued threat of large- scale, high- intensity wildland fires, the continued need for very aggressive suppression activities, and the associated erosion and sedimentation and potential loss of riparian habitats. Under Alternatives II and IV, the likelihood of high- intensity wildland fire and the need for aggressive suppression actions will be decreased substantially over time due to hazardous fuel reductions. Short- term impacts to foothill- yellow legged frogs, under these alternatives, will be minor and adverse, while long- term impacts will be moderate and beneficial.

Tailed frog (*Ascaphus truei*)

Tailed frogs occur in permanent streams of low temperatures in conifer dominated habitats including Douglas- fir, Klamath mixed- conifer, and ponderosa pine habitats. It also occurs in montane hardwood- conifer habitats. Tailed frogs occur more frequently in mature or late- successional forests than in younger stands (Bury 1983, Bury and Corn 1988, Jennings and Hayes 1994) and are restricted to perennial streams of low temperature in steep- walled valleys with dense vegetation. Permanent water is critical because the aquatic larvae require 2- 3 years to transform (Zeiner et al. 1988). Distribution of the tailed frog is not known at Whiskeytown, although confirmed observations have been reported from Brandy Creek, Crystal Creek, and their tributaries.

Potential for Catastrophic Fire, and its Effects. Catastrophic wildland fire could likely alter habitat important to tailed frogs. The most likely scenario would be that a catastrophic wildland fire would consume large amounts of overstory conifers and riparian habitats, which would allow streams to receive more sunlight and warm up to temperatures unsuitable to tailed frogs. A secondary impact would be the increases in sedimentation of streams that is likely to significantly increase following catastrophic fire. Increases in sedimentation will adversely impact egg masses, tadpoles, and adults. Impacts from catastrophic fire on tailed frogs would be moderate, adverse, and long- term, based primarily on the increased stream temperatures and sedimentation of aquatic habitats.

Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of large- scale high intensity fires and adverse effects on foothill tailed frogs. Impacts of Alternatives I and III on tailed frogs would, therefore, be major, adverse, and long- term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Fire Management Treatments.

Prescribed Fire. Although prescribed fire would be limited under Alternative I, some benefit to tailed frogs would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation and overstory conifers which are known to be important habitat components of tailed frogs. Negligible increases in sedimentation to streams may occur post- fire due to exposed soil along control lines. Portable pumps are often placed in streams during prescribed fires and the risk for fuel spills into the stream is present. Fuel spills into the stream would have a moderate, adverse, short- term impact to tailed frogs. Overall impacts of prescribed fire on tailed frogs will be similar to those of foothill yellow- legged frogs (see above).

Site Preparation Associated With Prescribed Fire (handline construction, snagging). Impacts will be the same as foothill yellow- legged frogs (see above).

Mopup. Impacts will be the same as foothill yellow- legged frogs (see above).

Level 1 Mechanical Fuel Treatment. Impacts will be the same as foothill yellow- legged frogs (see above).

Pile burning. Pile burning will not occur in riparian habitats and will not likely impact tailed frogs.

Chipping. Chipping will not occur in riparian habitats and will not likely impact tailed frogs.

Wildland Fire Suppression. Impacts associated with Wildland Fire Suppression will be the same as foothill yellow- legged frogs (see above).

Level 2 Mechanical Fuel Treatment. Impacts associated with Wildland Fire Suppression will be the same as foothill yellow- legged frogs (see above).

Wildland Fire Use. Impacts associated with Wildland Fire Use will be the same as foothill yellow- legged frogs (see above).

Conclusion. Impacts to tailed frogs from Alternatives I and III will be minor, adverse, and long-term based on the continued threat of large- scale, high- intensity wildland fires, the continued need for very aggressive suppression activities, and the associated erosion and sedimentation and potential loss of shading from overstory vegetation. Under Alternatives II and IV, the likelihood

of high- intensity wildland fire and the need for aggressive suppression actions will be decreased substantially over time due to hazardous fuel reductions. Short- term impacts to tailed frogs, under these alternatives, will be minor and adverse, while long- term impacts will be moderate and beneficial.

Northwestern pond turtle (*Clemmys marmorata marmorata*)

The northwestern pond turtle is associated with permanent or nearly permanent water in a wide variety of habitat types (Zeiner et al. 1988). Pond turtles require basking sites such as partially submerged logs, rocks, mats of floating vegetation or open mud banks. Hibernation in colder areas is passed underwater in bottom mud. Two distinct habitats may be used for oviposition. Along large slow- moving streams, eggs are deposited in nests constructed in sandy banks. Along foothill streams, females may climb hillsides, sometimes moving considerable distances to find a suitable nest site (Storer 1930). Whiskeytown contains both habitat types and both types of sites are likely used for oviposition.

Potential for Catastrophic Fire, and its Effects. Catastrophic wildland fire would likely have little impact to pond turtles or their habitat, although nests may be destroyed by prolonged high intensity fires. Fire may actually create more favorable nesting sites by allowing sunlight to reach the forest floor (Bury, B. Pers. Comm.). Impacts to pond turtles under all alternatives will be negligible.

Fire Management Treatments

Prescribed fire. Prescribed fires will not likely adversely impact the northwestern pond turtle or their habitat. More favorable nesting sites may be created by opening dense or closed canopy chaparral or forests.

Site Preparation Associated with Prescribed Fire (handline construction, snagging). Site preparation associated with prescribed fire will likely have little impact to the pond turtle or it's habitat. There is a very small possibility that nests could be destroyed by ground disturbing activities associated with handline construction. Impacts from site preparation associated with prescribed fire on pond turtles under all alternatives will likely be negligible.

Mopup. The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire would not likely impact the northwestern pond turtle.

Level 1 Mechanical Fuel Treatment. Thinning of brush and creation of shaded fuel breaks will not adversely impact pond turtles and may create more favorable nesting sites by opening dense, closed canopy chaparral. Impacts of Level 1 mechanical fuel treatments, under all alternatives, will likely be minor, short- term, and beneficial.

Pile Burning. Pile burning would likely destroy nests in the event a pile was created and burned directly above a nest site. The chances of this occurring are small. Impacts associated with pile burning under all alternatives is negligible.

Chipping. Chipping would not have impacts to the northwestern pond turtle.

Wildland Fire Suppression. Retardant drops could adversely affect northwestern pond turtles through contamination of their aquatic habitat. Protocols for retardant use at Whiskeytown restrict its use within 300 feet of water, which lessens the chances of the chemicals reaching water. Nevertheless, it is likely that some chemicals from retardant use will flush into streams during rains and the possibility exists for accidental drops directly in streams. Impacts of retardant use on pond turtles are potentially moderate, adverse, and short- term, based primarily on the possibility of accidental retardant contamination of streams. Water drops will not likely have an

impact on pond turtles. These impacts will likely be similar for all alternatives as fire suppression strategies within the lower elevations of Whiskeytown, which are occupied by the pond turtle, rely on aggressive initial attack with airtankers and helicopters during periods of high fire risk, regardless of fire size.

Helispots and spike camps would have limited use in pond turtle habitat, and would be sited away from such sensitive habitats. Hand and dozer lines would likely have negligible impacts to northwestern pond turtles under all alternatives. Overall impacts of wildland fire suppression actions on pond turtles under Alternatives II and IV would be minor, adverse, and short-term due to the potential of contaminating aquatic habitats with retardant. Impacts resulting from wildland fire suppression under Alternative III will likely be more severe as the probability of large, intense fires requiring multiple retardant drops is higher. Impacts under Alternative I are less than Alternative III and more than Alternatives II and IV.

Helispots and spike camps would not impact western pond turtles. Dozer lines, and to a lesser extent, hand lines could potentially destroy underground nests. Overall impacts of wildland fire management actions on tailed frogs under all alternatives would be minor, adverse, and short-term.

Conclusion. Impact to western pond turtles under all alternatives would be minor, adverse, and short-term mainly due to the potential for contamination of aquatic habitats with retardant and possibility of nest destruction from line construction or mechanical fuel treatments.

Pacific western big-eared bat (*Corynorhinus (=Plecotus) townsendii townsendii*)

The pacific western big-eared bat is found in all but subalpine and alpine habitats in California and may be found at any season throughout its range. It is most common in mesic habitats and feeds principally on small moths. The species requires caves, mines, tunnels, buildings, or other human-made structures for roosting and roosting sites are thought to be the limiting resource and the species is extremely sensitive to disturbance of roosting sites (Zeiner et al. 1990). Some surveys of potential roosting sites have been completed within the park and individual pacific western big-eared bats have been observed in mines and buildings at several locations.

Potential for Catastrophic Fire, and its Effects. Catastrophic wildland fire would not likely have direct impacts to pacific western big-eared bats. More likely, the bats would be indirectly negatively impacted by loss of habitat necessary to prey species. Catastrophic wildland fire could consume large amounts of riparian habitats that are necessary to many species of moths, which are their primary prey source. Impacts from catastrophic fire on pacific western big-eared bats under Alternatives I and III would be moderate, adverse, and short-term, primarily due to the potential loss of riparian habitats necessary to prey species. Potential for catastrophic fire will be substantially decreased over time under Alternatives II and IV and will be minor, adverse, and short-term.

Fire Management Treatments.

Prescribed Fire. Some benefit to pacific western big-eared bats would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation. Overall impacts of prescribed fire on pacific western big-eared bats under all alternatives would be minor, beneficial, and long-term due to the reduction of risk of catastrophic wildland fire.

Site Preparation Associated With Prescribed Fire (handline construction, snagging). Handline construction and snagging will not likely to have impacts to the pacific western big-eared bat.

Mopup. Mopup will not likely have impacts to the pacific-western big-eared bat.

Level 1 Mechanical Fuel Treatment. Thinning and shaded fuel break construction would have an indirect benefit to the pacific western big-eared bat by lessening the potential for large-scale high severity wildland fires and therefore, reducing impacts to riparian areas. Impacts under Alternatives I, III, and IV would be minor, long-term, and beneficial. Level 1 Mechanical Fuel Treatment will occur only on a very limited basis under Alternative II and impacts will be negligible.

Pile burning. Pile burning will not likely impact the pacific western big-eared bat.

Chipping. Chipping is not likely to impact the pacific western big-eared bat.

Wildland Fire Suppression. Wildland fire suppression activities will likely have negligible impacts to the pacific western big-eared bat.

Level 2 Mechanical Fuel Treatment. Level 2 Mechanical Fuel Treatment will likely have negligible impacts to the pacific western big-eared bat.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment will likely have negligible impacts to the pacific western big-eared bat.

Wildland Fire Use. Wildland Fire Use will not likely impact the pacific western big-eared bat.

Conclusion. Impacts to the pacific western big-eared bat under Alternative I and III would be minor, adverse, and short-term due primarily to the continued threat of large-scale high-intensity wildland fire and the potential for loss of riparian habitats necessary for their primary prey species. Under Alternatives II and IV, the likelihood of large-scale high-intensity wildland fire and the potential for loss of large amounts of riparian areas will be decreased substantially over time due to hazardous fuel reductions. Overall impacts will be long-term, minor, and beneficial.

State-listed Species

Willow flycatcher (*Empidonax trailii*) – California Endangered

In the past, willow flycatchers nested in California wherever willow thickets in wetlands, meadows, or riparian areas were found (Grinnell and Miller 1944). Dense willow thickets are required for nesting and roosting. The species most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows (Serena 1982). In recent decades, breeding populations have disappeared from low elevation habitats in the state. Alteration and destruction of riparian and meadow habitats is thought to be the principal cause for this decline (Remson 1978). Other contributing factors may include nest parasitism by brown-headed cowbirds, disturbance from grazing, and disturbance on wintering grounds (Serena 1982). Willow flycatchers arrive in California from Central and South American wintering grounds in May and June. They depart in August with some transients noted through mid-September (Zeiner et al. 1990).

Willow flycatchers have not been documented at Whiskeytown, but have been observed within the Clear Creek watershed south of the park boundary. Areas within the park which may contain suitable habitat occur in the Clear Creek drainage between Whiskeytown Dam and the park boundary and along Upper Clear Creek above Carr Powerhouse.

Potential for Catastrophic Fire, and its Effects. The long-term response of willow flycatchers and their habitat to fire is not known. Most areas containing large stands of willows remains

somewhat wet throughout the year, but it is possible that under severe drought or high- wind conditions riparian areas containing a large willow component would burn during a catastrophic wildland fire. Willows are capable of resprouting and reoccupying areas fairly quickly, but at the least, a short- term moderate adverse impact is likely.

The risk of catastrophic fire is greatest under Alternative III, due to the minimal amount of fuel treatment that would be accomplished, resulting in a greater potential for catastrophic fires over time. The risk of catastrophic fire is also fairly high under Alternative I due to the relatively slow pace of treatment of accumulated fuels. Impact of catastrophic fire on willow flycatchers under Alternative I and III would be moderate, adverse, and long- term, based upon the continued threat of catastrophic wildland fire. The risk of catastrophic wildland fire that potentially could consume riparian areas will be decreased substantially over time under Alternatives II and IV due to the aggressive treatment of hazardous fuels.

Fire Management Treatments.

Prescribed Fire. Prescribed fires are not planned to occur in the riparian habitats used by the willow flycatcher. Prescribed fires occurring adjacent to riparian habitats may cause temporary decreases of some insect prey species utilized by the willow flycatcher.

Impacts of prescribed fire on willow flycatchers under Alternatives I, II, and IV would be minor, beneficial, and long- term, based upon the modest reduction in the threat of catastrophic fire that would occur. Impacts of prescribed fire on the willow flycatcher under Alternative II will be negligible.

Site Preparation Associated with Prescribed Fire (handline construction, snagging). Fire control lines are not constructed in the riparian areas that produce suitable habitat for the willow flycatcher. Additionally, snags are not likely to be felled in or near riparian habitats and are not thought to be an important habitat component. Site preparation associated with prescribed fire will have negligible impacts to the willow flycatcher under all alternatives.

Mopup. Mopup activities will not likely impact willow flycatchers.

Level I Mechanical Fuel Treatments. Hand thinning and construction of shaded fuel breaks would have a negligible effect on willow flycatchers, because these operations would not occur in riparian habitats.

Pile Burning. Pile burning will not impact the willow flycatcher.

Chipping. Chipping would not occur in or near riparian habitats containing suitable willow flycatcher habitat.

Wildland Fire Suppression. Water and retardant drops are very unlikely to affect willow flycatchers because the habitat flycatchers occupy is relatively wet, and does not typically carry fire. Existing procedures for retardant use also restrict its use to areas away from streams. Helispots could affect willow flycatchers if they are located near nesting areas, and the amount of helicopter traffic were enough to cause frequent disturbance. If willow flycatchers are documented within the park, helispots be located away from potential nesting sites. Spike camps are prescribed to be established outside of sensitive habitats, such as riparian areas, and therefore would not have impacts to willow flycatchers. Handlines could have an adverse effect on willow flycatchers if they were constructed through riparian areas and involved the removal of willows. These habitats, however, usually contain enough moisture that they do not carry fire, making fire lines unnecessary. Also, fire line construction guidelines call for the avoidance of sensitive habitats, such as riparian areas when possible. Snag removal would have no effect on willow

flycatchers as snags are not an important component of willow flycatcher habitat, and are not commonly found in riparian areas. Mopup activities are unlikely to impact willow flycatchers.

Overall, actions taken to manage wildland fires would have a negligible impact on willow flycatchers under all alternatives.

Level 2 Mechanical Fuel Treatment. Level 2 Mechanical Fuel Treatment will likely have negligible impacts to the willow flycatcher.

Level 3 Mechanical Fuel Treatment. Level 3 Mechanical Fuel Treatment will likely have negligible impacts to the willow flycatcher.

Wildland Fire Use. Wildland Fire Use will not impact the willow flycatcher.

Conclusion. The risk to willow flycatchers from fire management and fuels reduction activities is negligible to minor under all alternatives. The greatest threat is that of a high- intensity wildland fire that potentially could consume riparian areas. This threat is least under Alternatives II and IV which prescribe aggressive treatments of hazardous fuels.

Geophysical Environment

Soils and Water Quality

Methodology

The methodology for assessing fire management activities to Whiskeytown's soil and water quality is through a combination of the professional knowledge and experience of the Whiskeytown Natural Resource Management staff and literature review.

The manner in which environmental impacts are measured for both soil and water quality is listed below.

Type of impact

Adverse: Likely to result in unnatural changes in physical and chemical properties of soil and water.

Beneficial: Likely to protect and /or restore the natural physical and chemical properties of soil and water.

Duration of impact

Short- term: Immediate changes in the physical and chemical properties of soil and water where the impacts last one hydrologic season.

Intermediate- term: Immediate changes in the physical and chemical properties of soil and water where the impacts last two to four hydrologic seasons.

Long- term: Immediate changes in the physical and chemical properties of soil and water where the impacts last more than four hydrologic seasons.

Intensity of impact

Negligible: Imperceptible or undetectable impacts.

Minor: Slightly perceptible, and limited in extent. Without further impacts, adverse impacts would reverse and the resources would recover.

Moderate: Readily apparent, but limited in extent. Without further impacts, adverse impacts would eventually reverse and the resource would recover.

Major: Substantial, highly noticeable, and affecting a large area. Changes would not reverse without active management

Regulations and policies affecting soil and water quality

Regulations and policies governing soil and water quality include: the Clean Water Act, the Endangered Species Act, the National Park Service Organic Act, National Park Service Management Policies 2001, Whiskeytown's General Management Plan and Resource Management Plan.

Issues and impacts common to all alternatives for soil and water quality

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality. All alternatives have suppression as a strategy; with Alternative IV including wildland fire use when ignitions occur naturally.

Suppression

Direct

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated less than 200° C for long duration can create hydrophobic layers. Hydrophobic soils reduce infiltration and concentrates flow, increasing erosion. Actions include direct fire suppression. There would be a beneficial or adverse, short- term to long- term, and negligible to major impacts from these actions.

Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions include: construction of dozer line, hand line, containment lines, safety zones, heli- spots, drop points, staging areas, and road improvements. There would be adverse or beneficial, short- term to long- term, and negligible to major impacts.

There may be some soil erosion from water, retardant, water- foam applications. Actions include water and retardant drops from fixed and rotary wing aircraft, water applications from engine pumping, and hand application. There would be a range of beneficial or adverse, short- term to intermediate- term impacts, and negligible to moderate impacts.

There may be some native water depletion from pumping water from streams, lakes, impoundment's, and groundwater sources. Dipping buckets, and pumping water from streams and aquifers can increase turbidity or scour fines from channels, diminishing water quality and quantity. There would be adverse, short- term to long- term, and negligible to major impacts.

Indirect

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the burn, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short- term to intermediate- term impacts, and negligible to major impacts.

There may be some water quality degradation from increased sedimentation from increased use of roads and trails, construction of dozer line, hand line, containment lines, safety zones, heli- spots, drop points, staging areas, and road improvements. There would be a range of adverse, short- term to long- term, and negligible to major impacts.

There may be some water quality degradation from discharge of fire retardant or foam into the environment. Action includes air or ground based applications and incidental spillage of retardant and foam. There would be a range of adverse, short- term to long- term, and negligible to major impacts.

Cumulative

There may be some water quality degradation of Whiskeytown Lake and lower Clear Creek from chronic delivery of sediment, retardant and foam, and nutrients. Several suppression incidents within one fire season could result in adverse, short- term to long- term, and negligible to major impacts.

Prescribed Fire

Direct

Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions common to all alternatives include: fire ignition of burn piles, holding, and reconnaissance. There would be a range of beneficial or adverse, short- term to long- term, and negligible to moderate impacts from implementation of these actions.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions common to all alternatives include ignition of burn piles. There would be a range of beneficial or adverse, short- term to long- term, and minor to major impacts from implementation of these actions.

Indirect

There may be some water quality degradation from increased sedimentation from increased use of roads and trails and fire ignition, and reconnaissance. There would be a range of beneficial or adverse, short- term to long- term, and negligible to moderate impacts.

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the pile burns, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short- term, and negligible to moderate impacts from implementation of these actions.

Cumulative

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Action includes repetitive use of burn pile locations. There would be adverse, short- term to long- term, and minor to major impacts from implementation of this action.

Mechanical Treatment Level 1

Direct

Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions include: fuel reduction, pile burning, and area reconnaissance, install and maintain shaded fuel break s, and rehabilitate pile burn rings and trails. There would be a range of beneficial or adverse, short- term to long- term, and negligible to major impacts.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions include pile burning. There would be a beneficial or adverse, short-term to long-term, and negligible to moderate impacts.

Indirect

There may be some increased erosion from rain-drop impact. Actions include vegetation removal and vegetation mulching due to increase of duff layer and decrease in vegetative cover. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation from increased sedimentation from increased use of roads and trails to access the fire for suppression. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils at pile burn sites. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the burn, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Cumulative

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated less than 200° C for long duration can create hydrophobic layers. Hydrophobic soils reduce infiltration and concentrates flow, increasing erosion. Actions include use of same burn pile areas, season after season. There would be a beneficial or adverse, short-term to long-term, and negligible to major impacts from these actions.

There may be some reduction of duff and vegetation cover as ground conditions convert to a more natural fire regime. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Fire cache relocation and rebuilding park headquarter administrative building

Direct

There may be some soil compaction and erosion from increased heavy equipment, motorized vehicle, and foot traffic in already developed areas. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Indirect

There may be some water quality degradation from increased sedimentation as a result of increased cleared areas and concentration of flow. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Alternative I

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative in context of soil and water quality.

Suppression

Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Prescribed Fire

Prescribed fire impacts for Alternative I are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality, and also include broadcast burns, control line construction and rehabilitation, shaded fuel break maintenance, and construction of water bars.

Direct

There may be some soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include: broadcast burns and holding and reconnaissance of those burns, control line construction, shaded fuel break maintenance, construction of water bars, and rehabilitation of control lines. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts from implementation of these actions.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions include ignition of broadcast burns. There would be a range of beneficial or adverse, short-term to long-term, and minor to major impacts from implementation of these actions.

Indirect

There may be some water quality degradation from increased sedimentation from increased use of roads and trails for broadcast burn ignition, holding, and reconnaissance of fire ignition, control line construction, shaded fuel break maintenance, construction of water bars, and rehabilitation of control lines. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the broadcast burns, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term, and negligible to major impacts from implementation of these actions.

Cumulative

There may be some soil and water quality alteration to a natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial, long-term, major impact from this condition.

Mechanical Treatment Level 1

Mechanical treatment level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Alternative II

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality.

Suppression

Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality and Alternative I.

Prescribed Fire

Prescribed fire impacts for Alternative II are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, but would not include construction of water bars and construction and rehabilitation of control lines.

Mechanical Treatment Level 1

Mechanical Treatment (Level 1) impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Alternative III

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality

Suppression

Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Prescribed Fire

Prescribed fire impacts for Alternative III are described in the previous sections, Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, but, would includes construction of shaded fuel breaks, but would not construct water bars, and no shaded fuel break maintenance.

Direct

Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include construction of shaded fuel breaks. There would be a range of beneficial or adverse, short- term to long- term, and negligible to moderate impacts from implementation of these actions.

Indirect

Water quality degradation from increased sedimentation from increased use of roads and trails for construction of shaded fuel breaks. There would be a range of beneficial or adverse, short-term to long- term, and negligible to major impacts.

Mechanical Treatment Level 1

Mechanical Treatment Level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Mechanical Treatment Level 2

Direct

Soil compaction and erosion from increased motorized vehicles in developed and undeveloped areas with a slope less than 30 percent. Actions for this alternatives that increase compaction and erosion would include use of heavy equipment, tracked or wheeled, for brush- reduction. There

would be a range of beneficial or adverse, short- term to long- term, and moderate to major impacts from implementation of this action.

Indirect

There may be some water quality degradation from increased sedimentation from impact of heavy equipment on slopes less than 30 percent. There would be adverse, short- term to long- term, and negligible to major impacts.

Cumulative

There may be some soil and water quality alteration to a more natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial, long- term, major impact from this condition.

Alternative IV

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality and include all actions covered in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I.

Suppression

Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality, with the exception that a natural ignition maybe managed for wildland fire use for resource management, which the impacts are covered in the preceding subsection in Alternative IV, Wildland Fire Use For Resource Management.

Prescribed Fire

Prescribed fire impacts for Alternative IV are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, but would not include water bar construction and control line construction.

Mechanical Treatment Levels 1 and 2

Mechanical Treatment (Level 1) impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality. For mechanical treatment level 2, the impacts discussed in the preceding section Alternative III would be the same as for Alternative IV.

Mechanical Treatment Level 3

Direct

There may be some soil compaction and erosion from increased motorized vehicles in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include use of equipment for brush and small tree removal. There would be a range of beneficial or adverse, short- term to long- term, and moderate to major impacts from implementation of this action.

Indirect

There may be some water quality degradation from increased sedimentation from impact of heavy equipment. There would be adverse, short- term to long- term, and moderate to major impacts.

Cumulative

There may be some soil and water quality alteration to a more natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial and adverse, long-term, moderate to major impact from this condition.

Wildland Fire Use

Direct

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions include active burning. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts from implementation of these actions.

Indirect

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the broadcast burns, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term, and negligible to major impacts from implementation of these actions.

Cumulative

There may be some soil and water quality alteration to a more natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial and adverse, long-term, moderate to major impact from this condition.

Wetlands and Floodplains

Whiskeytown has some scattered mineral springs located at lower elevations in the park and in active floodplain areas along riparian corridors. Impacts associated with these types of landforms and habitats are discussed in the vegetation and water quality sections above (see Riparian Community for floodplains) and in the Areas of Special Designation (for mineral springs).

Air Quality

Impacts and Issues Common to all Alternatives

Smoke is an inevitable by-product of a fire-evolved ecosystem. Smoke would be produced from wildland fires occurring during the drier fire season months and from prescribed burning accomplished during periods with lower potential loss levels. Smoke emissions from unwanted wildland fires would continue to occur at some level every year under all alternatives. Some alternatives allow more control over when and where fires, and hence when smoke events, occur. All individual wildland fire use and prescribed fire projects under all alternatives are subject to approval at the time of implementation by the Shasta County Air Pollution Control District.

The park must abide by the laws and regulations of California. Prescribed burning would be accomplished only when permitted by the responsible local or state level regulatory agency. Generally, the effects of prescribed burning have a short duration of no more than 3 to 5 days. Wildfires similar to those in 1999 could affect the park for several weeks.

Smoke behavior, and corresponding impacts, is a complex issue involving a number of dynamic elements:

1. The amount and type of fuel that would burn.

Restoration areas have the highest fuel loading. Much of the fuel load in those areas (up to 50%) consists of 100 years of accumulated duff, which burns mostly in the smoldering phase and produces more particulates than an equivalent number of tons burning in the flaming phase.

Maintenance areas have less fuel overall and much less duff (less than 25% total fuel load) per acre than restoration burns. A higher percentage of fuels burn in the flaming phase resulting in a significantly lower rate of emissions.

2. The type of fire situation and controllability.

Prescribed burn operations are the most controllable and predictable of all fire events. Wildland Fire Use (Wildland Fire Use) fires generally provide opportunities for careful planning and management, though their random nature and, often, long duration make them somewhat less predictable to manage than prescribed burn operations. Generally, large unwanted suppression fires are the most uncontrollable and least predictable.

3. The time of year smoke is produced.

Fall and early winter generally have climatic conditions least favorable to smoke dispersion, while spring and summer generally have better conditions for dispersing smoke.

4. The exact behavior of the smoke plume, including the direction and elevation that the smoke plume moves, and resulting concentrations at ground level. The behavior of the plume is highly dependent on elevation and dynamic meteorological conditions occurring at the time of the fire event. Generally, the higher the elevation of the burn, the greater the mixing volume of air to dilute it. Higher elevation winds also tend to better dilute and disperse smoke at lower concentrations. High level winds may transport dispersed smoke particles large distances. Complex geography and weather patterns complicate the ability to exactly predict the quantity and destination of smoke particles in the plume.

5. The interaction of smoke from park fires with pollution sources in the Sacramento valley (including other fires in the area).

During fire season, there is the potential for significant amounts of smoke from fires on U.S. Forest Service, Bureau of Land Management, and state lands, as well as mobile and stationary sources of pollutants, including the Knauf Fiberglass plant and other manufacturing sites and ozone produced during the hot summer days.

6. The ability to effectively model all variables in a dynamic environment.

As with most meteorological forecasting, the best and most accurate information is available close to the time of interest. While long- term climatic models are valuable in advance fire program planning, it is the conditions that exist at the time of the actual fire event that are the best indicators of potential smoke impacts.

As individual fire events occur under constantly changing environmental conditions, and many occur randomly through space and time, sophisticated air quality modeling beyond the scope of this environmental impact statement and current technology would be needed in order to determine whether the estimated increases in smoke emissions proposed in these

alternatives would cause actual exceedances of annual and 24 hour National Ambient Air Quality Standards within the Sacramento valley air basin at any point in time. In lieu of such modeling, complying with burn/no burn day designations issued by the District, and by using the best available meteorology and forecasting at the time of ignition are techniques that would be used to manage local and regional smoke effects and maintain emissions within the NAAQS under all alternatives. The District provides significant input into park decisions as individual projects are proposed for implementation. Modeling and forecasting meteorological conditions related to smoke dispersion and assessing potential impacts on regional conditions assist the park in determining whether to proceed with ignition.

7. Dense smoke would likely occur in the vicinity closest to fire operations.

Unhealthful concentrations of smoke would be most likely to affect fire personnel immediately adjacent to the fire. Most smoke plumes from fire operations would disperse at middle to upper elevations (6,000 to 12,000 feet) into remote, low population areas and, occasionally, into more heavily populated areas of the Sacramento valley.

Methodology

Criteria Pollutants

The most significant air quality issue that interacts with the proposed actions is the designation of the Sacramento valley air basin as a non-attainment area for two criteria pollutants [ozone and PM₁₀ (particulate matter less than ten microns)] as defined by the Federal Clean Air Act. Both pose public health and safety concerns, though ozone in particular is also a pollutant with significant ecological consequences. Carbon dioxide is also a criteria pollutant that must be considered due to its importance and impact in the global warming issue. Of the air quality related values to be considered in this document, the production and management of PM₁₀ is the most significant.

PM₁₀ is the pollutant of primary concern in relation to the actions proposed in this document, although PM_{2.5} (particulate matter less than 2.5 microns) is just as important as a pollutant because of the health effects of smaller size particles remaining in a person's lungs and the respiratory illnesses related to this situation. The Shasta County Air Pollution Control District (hereinafter referred to as the District) has written an Attainment Plan to address the health effects of ozone and PM₁₀. The plan primarily addresses measures to reduce ozone levels in order to meet established deadlines set for complying with National Ambient Air Quality Standards (NAAQS), although the rules on prescribed burning have also been revised. Smoke Management Plans are now required well in advance of a prescribed burn to assist the District in determining who would be allowed to burn on a particular day. The park is encouraged to work with the state and federal agencies that conduct prescribed burning within the air basin. Smoke management requirements are dynamic and require considerable consultation with the District prior to and during implementation.

Since wildland fires may contribute significant levels of PM₁₀, an analysis of each alternative was undertaken to assess the PM₁₀ emissions, as well as other byproducts of the forest fire process, generated under each as a way to compare to current program emissions.

Smoke Emissions Estimates

In order to quantify the smoke emissions that are predicted to result from each of the alternatives considered in the fire management plan, the First Order Fire Effects Model 5.0 (FOFEM) was utilized to generate emission factors for PM₁₀, PM_{2.5}, VOC (as CH₄), CO, and CO₂. FOFEM is a

computer- based planning tool that is used to provide quantitative predictions for planning prescribed fire, for impact assessment, and for long- range planning and policy development (Reinhardt et al.). FOFEM provides quantitative fire effects information for tree mortality, fuel consumption, mineral soil exposure, and smoke. The smoke module of FOFEM models emissions production, but not dispersion or visibility. The smoke module requires a number of inputs related to the burn characteristics, including fuel category, cover type, fuel loading, moisture content, percent of crown burn, and others. To arrive at the best possible estimates, park- specific fuel load data was utilized where it was available. The resulting emission estimates were used to draw comparisons between alternatives.

The area of each fire management plan cover type in a given prescribed burn unit was determined using GIS data. This was accomplished by intersecting two GIS datasets: the prescribed burn unit areas and plant communities. The plant communities were then correlated with the parks' fire effects monitoring types and the Society of American Foresters (SAF)/Society for Range Management (SRM) cover types available in FOFEM. In some cases, direct correlation between cover types was not possible and a surrogate SAF/SRM cover type was selected. For example, Pacific Ponderosa Pine was used to model both the park's Ponderosa Pine and Mixed Conifer forests. The table below provides a cross- reference for cover types. Not all cover types occurred within all burn units. The most prevalent monitoring/cover types are Mixed Conifer, Mixed Oak Woodland, Knobcone Pine, and Chaparral.

Table 4 –2 Vegetation cover types for Whiskeytown National Recreation Area

Monitoring Type	Vegetation Description	SAF/SRM Type	SAF/SRM Description
N/A	Bare Rock	N/A	N/A
N/A	Water	N/A	N/A
QUKE (oak woodland)	Oak Woodland	246	California Black Oak
N/A	Blue Oak Grassland	201 (SRM)	Blue Oak Woodland
PIAT (knobcone pine)	Knobcone Pine	248	Knobcone Pine
N/A	Riparian	422 (SRM)	Riparian
PIPO (ponderosa pine)	Ponderosa Pine	245	Pacific Ponderosa Pine
PIPO	Mixed Coniferous Forest	245	Pacific Ponderosa Pine
N/A	Montane Chaparral	209 (SRM)	Montane Shrub land
ARVI (greenleaf manzanita)	Chaparral	207 (SRM)	Scrub Oak Mixed Chaparral

Whiskeytown is in the process of developing a vegetation and fuels map which would provide a much higher level of accuracy and detail with regard to the park's vegetation cover types and fuel models. Until this project is completed, the park must rely on older data and data which has not been ground- truthed for accuracy.

To best represent fuel loads, information used in the model was based on the default values for each vegetative cover type used in FOFEM and data collected from park- wide fire effects monitoring plots. Due to the heavy fuel loadings at Whiskeytown, fuel loading data from standard fuel model descriptors were occasionally used if it more accurately reflected the characteristics of a particular vegetation type.

For a given prescribed burn unit and pollutant, the emissions were quantified by the following equation:

$$E = \sum_{c=1}^n EF_c * A_c, \text{ where}$$

E = emissions, tons/year

EF_c = emission factor for coverage c, tons/acre

A_c = area of coverage c, acres

Average emission factors for all prescribed burns were calculated from the FOFEM predictions in order to facilitate comparison of alternatives. The average emission factors were used to quantify emissions from prescribed fire and wildland fire use, since both are expected to have similar burn characteristics. However, separate FOFEM runs were used to develop emission factors for unwanted wildfire since it can be expected to typically burn under drier conditions and consume more fuel, particularly crown and branch fuels, and therefore, result in higher emissions. In order to develop average wildfire emission factors, representative burn parameters for unwanted wildfire were provided by park staff for the four predominant cover types: mixed conifer, mixed oak woodland, knobcone pine, and chaparral.

The alternatives in this document are structured around several primary fire management strategies (suppression, prescribed fire, wildland fire use, and mechanical treatments). Park staff estimated the number of acres to be treated for each strategy under each alternative. The emissions estimates that follow in this section were generated for an eight- year period, the length of time that prescribed fire and mechanical treatment plans extend out in the fire management plan.

Both the prescribed and wildfire emission factors predicted by FOFEM are considerably higher than similar emission factors in EPA's *Compilation of Air Pollution Emission Factors* (AP- 42) for the same region and the default values in California's *Smoke Management Guidelines for Agricultural and Prescribe Burning* which are used when applying for a burn permit from the Shasta County Air Pollution Control District. Both the AP- 42 and California- derived emission factors are generalized for large regions and "can vary by as much as 50 percent with fuel and fire conditions." In addition, since fuel loadings in many areas of the park may be heavier than normal due to a history of fire suppression, the average emission factors used here can be considered more representative of the park. Finally, the FOFEM model does not provide emission factors for NO_x. According to the EPA AP- 42 emission factors, the emission factors for NO_x from wildfires and prescribe burning are approximately 35 times less than those for CO emissions. Therefore, the CO emission factors produced by the FOFEM model were scaled down proportionately to estimate NO_x emission factors. The table below provides the emission factors used for each fire type. The prescribed and wildland fire use emission factors are the same because both fires would be expected to burn with similar characteristics: low intensity and less crown consumption than wildfires.

Table 4-3 Composite Emission Factor Summary (Based on relative acreage)

Fire Type	Emission Factors (tons / acre)					
	PM10	PM2.5	VOC	CO	Nox	CO2
Prescribed	0.29	0.25	0.15	2.83	0.08	28.63
Wildland Fire Use	0.29	0.25	0.15	2.83	0.08	28.63
Wildfire	0.34	0.29	0.16	3.47	0.10	35.12

In its present configuration, FOFEM 5.0 does not exactly duplicate the consumption measured in the field by fire effects plots. However, the model does have the benefit of using algorithms that approximate the relationship between fuels that are burned in the flaming and smoldering phases. Modeling consumption using the two phases is important because significantly more smoke is produced in the smoldering phase than in the flaming phase given the same quantity of fuel burned.

Average emission factors were also developed for each vegetation/monitoring type (based on GIS data) from FOFEM. The number of acres estimated to be burned for each treatment type under each alternative were then multiplied by the emission factor to estimate the tons of emissions produced. Comparison of the alternatives is based on a listing of tentative burn unit projects and associated number of acres to be treated by prescribed burning for the years 2002- 2008.

Burn unit locations and schedules for each Alternative were developed by the park and prioritized based on park fire and resource management goals and objectives as well as the Wildland Urban Interface Plan that has been developed. In this way, the park would be able to treat areas of the park that are considered to be most at risk from unwanted fire and associated urban interface protection and achieve ecosystem restoration objectives as well. Large burn units may be burned in sections over the course of several years when unfavorable burning conditions and air quality concerns would prevent the entire unit from being treated in one calendar year or when a portion of the burn unit must be avoided due to other considerations, such as cultural and natural resource values or other management concerns.

Each of the alternatives is compared using the historical average (1971- 2001) for wildfire of 142 acres burned per year, including both lightning ignitions and human- caused ignitions, and 671 acres (1993- 2001) of prescribed burning (which included pile burning). It should be noted that the predicted future emissions for Alternative I are based on an average of 1400 acres per year, as this is the annual goal in the park's current fire management program. The historical average is less due to the inability to burn as many acres as desired each year. This was due to a variety of reasons, including a National Park Service- imposed moratorium in 2000, extreme wildfire seasons in 1996 and 1999, and unfavorable environmental conditions in other years. In total, approximately 14,000 acres of parkland have been specifically targeted for prescribed burning under the fire management plan. The table below summarizes the average annual emissions from various fire types that are estimated to have occurred within the park over the period referenced above.

Table 4 – 4 Historical Average Annual Fire Emissions for Various Fire Types in Whiskeytown National Recreation Area

Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ³	CO	NOx	CO ₂
Prescribed Burns ¹	671	207	178	107	2020	58	20899
Wildland Fire Use ¹	0	0	0	0	0	0	0
Wildfire ²	142	48	40	23	491	14	4973
Total	813	255	218	131	2511	72	25872

¹Average for 1993 -2001 (includes pile burning); ²Average for 1971-2001; ³As Methane

Air emissions from burn treatments would diminish over time with a return to regular fire return intervals since fuel loading and fuel consumption would decline as the ecosystem is restored. As the park is returned to a more ecologically natural state and heavy fuel loadings are reduced, it is expected that unwanted wildfires would also occur less frequently and burn less intensely in the long- term. It is unlikely that this would occur in the period for which the revised fire management plan will cover, however.

Emissions estimates were also made for pile burning operations. Although the prescribed burning emissions totals include pile burning emissions, piles would be burned at times of the year when prescribed burns would not be conducted, so the pile burning emissions would be spread out over a longer period of time than prescribed burn emissions would be. The table below summarizes both the emission factors for pile burning and the predicted average annual emissions for each alternative.

Table 4-5 Emission Factors and Predicted Air Emissions Associated with Pile Burning for Various Alternatives
Pile Burning Emission Factors

		PM _{10-ef}	PM _{2.5-ef}	CH _{4-ef}	CO _{-ef}	CO _{2-ef}
Pile Burning	(lb/acre)	437	370	206	4240	60340
	(tons/acre)	0.22	0.19	0.10	2.12	30.17

Pile Burning - Average Annual Emissions (tons/yr)

Basis	Acres	PM ₁₀	PM _{2.5}	CH ₄	CO	CO ₂
Historical	56	12	10	6	119	1690
Alt 1 Pile	112	24	21	12	237	3379
Alt 2 Pile	300	66	56	31	636	9051
Alt 3 Pile	22	5	4	2	47	664
Alt 4 Pile	320	70	59	33	678	9654

Type of Impact

Impacts were considered to be beneficial or adverse to air quality. Beneficial air quality impacts would reduce emissions or lower pollutant concentrations, while adverse impacts would increase emissions or raise pollutant concentrations.

Duration

The duration of the impact was considered to be short- term or long- term in nature. Short-term impacts (3- 5 days) would be associated with specific fire events, while long- term impacts would occur at the time that the park achieves a natural background.

Intensity

The intensity of an impact considers whether the impact is judged to be negligible, minor, moderate, or major relative to the No Action Alternative I. For this analysis, the impact would be the percent increase or decrease in air emissions between the Alternatives in relation to the No Action alternative. These are:

Negligible – ≤5 percent change in air emissions

Minor – 5 to 20 percent change in air emissions

Moderate – 21 to 50 percent change in air emissions

Major – >50 percent change in air emissions

Alternative I

Smoke from wildfires and prescribed burning is a complex mixture of carbon, tars, liquids, and gases. The major pollutants are particulate matter (PM), volatile organic compounds (VOCs), carbon monoxide (CO) and carbon dioxide (CO₂). Nitrogen oxides (NO_x) also is produced but in a relatively small quantity compared to the other pollutants. The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in an eight- year period 2002 to 2008 based on park burning plans and historical records, respectively.

Table 4-6 Predicted Air Emissions Associated with Various Fire Types in Whiskeytown National Recreation Area for Alternative I

Fire Type	ACRES	Emissions (tons)			CO	NOx	CO ₂
		PM ₁₀	PM _{2.5}	VOC ¹			
Prescribed Burns ¹	1400	431.6	369.5	223.8	4205.4	120.2	43463.3
Wildland Fire Use ²	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case) ³	1	47.7	40.4	23.2	491.1	14.0	4972.7
Wildfire (Worst Case) ⁴	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	1401	479.3	409.9	247.0	4696.5	134.2	48436.0

¹ As Methane

² Not included in current fire management program

³ Based on smallest number of acres in historical fire database

⁴ Based on largest number of acres in historical fire database

No significant changes would occur to the current annual fire program. PM- 10 emissions would not significantly change in the short- term. Occasional large, unwanted fire events would continue to affect local communities and regional air quality several times each decade. Proactive fuels management would decrease smoke events in some areas of the park over time. Over the long- term, fire fuels would accumulate in untreated areas of the park resulting in larger, less predictable unwanted fire events.

Generally, Alternative I would continue the practices of recent years, which would not meet the park's natural resources management objective of returning the park to its natural background. The impacts of catastrophic wildfires consuming areas of high fuel loadings on air quality would be adverse, short- term and major.

Due to the fact that the timing and location of prescribed fire can minimize smoke impacts, the impacts of prescribed fire smoke events would be adverse to beneficial, short- term and negligible..

Mechanical treatment activities that are currently being employed would continue under this Alternative. Most hand- thinning activities involving the use of chain saws would have negligible to minor, short- term and adverse effects upon air quality. Piles of fuels would have the potential to affect air quality, but generally piles are burned in the winter and spring months when there are very few other smoke events occurring simultaneously, thus limiting the amount smoke production. Pile burning would generally be limited to low- intensity, localized impacts, minimizing impacts to visitors and the local communities. Because the piles would be burned under atmospheric conditions specified by the county, the smoke effects would generally be localized. Impacts would be adverse, short- term and negligible.

Chipping would produce minimal levels of emissions. Noise from the chipper would be the greater effect upon visitors. There would be no need to move to another location to avoid the emissions. Effects would be adverse, short- term and negligible.

Under Alternative I, there would be no irreversible and irretrievable commitments to resource.

There are mitigation measures and a management commitment to mitigate the adverse effects of smoke and other emissions on air quality and visibility associated with prescribed burns. Together with overall priority considerations, such as firefighter and public safety, suppression actions are managed also to mitigate unacceptable air quality and smoke impacts. Various management techniques can be applied to reduce air emissions produced by prescribed and wildland burning. These reductions come almost exclusively by reducing the area burned, the fuel loading, or fuel consumption.

Whiskeytown fire management staff coordinates prescribed burning plans with fire management staff from other National Parks, National Forests, BLM Units, and State Agencies. The goal of this group is to assure that planned ignitions on federal and state lands in the Sacramento Valley and its environs do not adversely impact smoke sensitive areas in and around the burn area. Prior to each planned burn, the park must obtain a permit from the appropriate County level Air Quality Management District and must obtain meteorological approval to burn from the California Air Resources Board. It is the responsibility of these air quality regulatory agencies to coordinate the numbers of fires burning in a specific region.

Cumulative Impacts

There are other actions in the immediate area and the Sacramento Valley that could have cumulative impacts when viewed in the context of this document. These include simultaneous wildfire and prescribed fire events, agricultural burning, dirt road traffic, and mobile and stationary sources that could result in adverse, long- term and major impacts.

Alternative II

Air emissions associated with the estimated burning actions for Alternative II for the years 2002-2008 were estimated using the FOFEM model, and the results are summarized and compared to Alternative I in the table below. Due to the fact that so few acres have been treated historically and most everything likely to be burned would be treated for the first time (two units are scheduled to be re- burned in this plan), it would take longer for the park to achieve the lighter fuel loadings needed to attain its natural background state. With no wildland fire use included in this alternative, it would take longer for the park to attain its resource management objectives related to desired stand structure and density and for the park to attain a natural background state.

The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in the eight- year period 2002 to 2008 based on park burning plans and historical records, respectively, for Alternative II compared with Alternative I.

Table 4-7 Predicted Air Emissions Associated with Various Fire Types in Whiskeytown National Recreation Area for Alternative II

	Predicted Future Fire Emissions - Alternative 1 (No Action)						
	Emissions (tons)						
Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	1400	431.6	369.5	223.8	4205.4	120.2	43463.3
Wildland Fire Use ¹	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case)	1	47.7	40.4	23.2	491.1	14.0	4972.7
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	1401	479.3	409.9	247.0	4696.5	134.2	48436.0

¹As Methane

Predicted Future Fire Emissions - Alternative 2 (Prescribed Fire Emphasis)							
	Emissions (tons)						
Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	3000	937.9	802.9	485.7	9138.7	261.1	94945.8
Wildland Fire Use ¹	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case)	1	0.3	0.3	0.2	3.5	0.1	35.1
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	3001	938.3	803.2	485.8	9142.2	261.2	94981.0

¹As Methane

Under this alternative, there would be short- term, unavoidable adverse impacts to air quality due to the increased use of prescribed burning. As the park attains its natural background state over time, however, fuel loadings would be reduced. Because this alternative does not include wildland fire use and the 5- 8 year prescribed burn schedule is focused primarily on the western, northern, and eastern portions of the park, it is unlikely that this alternative would meet the park's natural resources management objective of returning the park to its natural background. Much of the park would still be susceptible to unwanted wildland fire events. The impacts of catastrophic wildfires consuming areas of high fuel loadings on air quality would be adverse, short- term and major.

Due to the exclusive use of prescribed fire in this alternative and the subsequent ability to select the timing and location of most fire events, the impacts of prescribed fire smoke events could be minimized.

PM₁₀ emissions would not significantly change in the short- term, as the primary difference between this alternative and No Action is the increased number of acres treated with prescribed fire. Occasional large, unwanted fire events would continue to affect local communities and regional air quality several times each decade. The duration and intensity of smoke from large unwanted fire events would decrease over time as heavy fuel concentrations were systematically reduced across the parks.

The increase in prescribed burning would result in additional short- term impacts from smoke generated by more burning. Due to the fact that the timing and location of prescribed fires, and that they would be ignited only under certain atmospheric conditions, would be controlled, the impacts of prescribed fire smoke events would be minimized and be adverse to beneficial, short-term and major.

The impacts from chain saw use and chipping would decrease under this alternative as a result of narrower firelines and fuel breaks. Boundaries for prescribed burn units would be installed both as firelines and fuel breaks, so there would be a combination of both narrow and wide clearings on the ridges and roads serving as burn unit boundaries.

The impacts from mechanical treatment activities are the same as those discussed in Alternative I.

Under Alternative II, there would be no irreversible and irretrievable commitments to resources.

There are mitigation measures and a management commitment to mitigate the adverse effects of smoke and other air emissions on air quality and visibility associated with prescribed burns. Together with overall priority considerations, such as firefighter and public safety, suppression actions are managed also to mitigate unacceptable air quality and smoke impacts. Various management techniques can be applied to reduce air emissions produced by prescribed and wildland burning. These reductions come almost exclusively by reducing the area burned, the fuel loading, or fuel consumption. Historically, suppressing wildfires often only delays the generation of emissions rather than reducing or eliminating them.

Methods to reduce emissions by reducing the area burned include mechanical treatments and concentration burning. Mechanical treatment may include removal of standing or downed trees and onsite chipping or pile burning. However, it is labor intensive and chipping requires road access that is frequently not available in remote areas. In addition, it may interfere with land management objectives if such treatment causes undue soil disturbance, stimulates alien vegetation invasion, impairs water quality, or removes material needed for nutrient cycling or small animal habitat. Concentration burning involves burning a subset of a larger area to be treated. Although this decreases the total area burned, the subset area burned would represent a high fuel loading with associated higher emissions.

Techniques to reduce fuel loading includes mechanical fuel removal, burning more frequently, and scheduling burns prior to the appearance of new fuels. Mechanical fuel removal is the same as that described above, but a prescribed burn follows it. Frequent, low- intensity fires can prevent unwanted vegetation from becoming established on the forest floor. This technique has positive land management effects since it may result in fire regimes that more closely mimic natural fire frequencies. Burning before new fuels appear may also reduce fuel loading. Examples include burning before vegetation drops its leaves in the fall and burning before brushy or herbaceous fuel greens up.

Emission reductions also can be achieved when significant amounts of fuel are at or above the moisture of extinction and therefore unavailable for combustion. Long- term emission reductions, rather than the postponement of emissions generation, are achieved only if the fuels that are left behind can be expected to decompose or otherwise be sequestered at the time of subsequent burning in the area.

Increasing combustion efficiency or shifting the majority of combustion away from the smoldering phase and into the more efficient flaming phase can reduce emissions. Methods to accomplish this include pile or windrow burning, rapid mop- up, appropriate ignition techniques and shortened fire duration. Pile or windrow burning generates more heat and burns more efficiently. It is effective for forest fuel types rather than brush type fuels. However, it can have adverse effects on soils and water quality since high temperature extremes can cause soil sterilization.

The mitigation measures discussed above are intended to be fire prescription elements to minimize or avoid impacts on sensitive receptors that are identified in the discussion of the Affected Environment. Additional measures that are adopted include the avoidance of conducting burns during heavy visitor use periods and the coordination with other regional agencies that also conduct burns and regulatory authorities.

Agency coordination for Alternative II is the same as Alternative I.

Cumulative impacts for Alternative II are the same as those discussed in Alternative I.

Alternative III

Average annual air emissions associated with the predicted burning actions for Alternative III for the years 2002- 2008 were estimated using the FOFEM model, and the results are summarized and compared to Alternative I in the table below. With no wildland fire use and minimal prescribed burning included in this alternative, it would take longer for the park to attain its natural resource management objectives related to desired stand structure and density and for the park to attain a natural background state.

The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in the eight- year period 2002- 2008 based on park burning plans and historical records, respectively, compared with the No Action alternative.

Table 4-8 Air Emissions Associated with Various Fire Types in Whiskeytown National Recreation Area

Predicted Future Fire Emissions - Alternative I (No Action)							
Emissions (tons)							
Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	1400	431.6	369.5	223.8	4205.4	120.2	43463.3
Wildland Fire Use ¹	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case)	1	47.7	40.4	23.2	491.1	14.0	4972.7
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	1401	479.3	409.9	247.0	4696.5	134.2	48436.0

¹As Methane

Predicted Future Fire Emissions – Alternative III (Suppression Dominated)							
Emissions (tons)							
Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	250	77.5	66.4	40.2	755.2	21.6	7821.6
Wildland Fire Use ¹	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case)	1	0.3	0.3	0.2	3.5	0.1	35.1
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	251	77.8	66.6	40.3	758.7	21.7	7856.8

¹As Methane

Under this alternative, there would be short- term, beneficial impacts to air quality due to the increase in shaded fuel breaks and the accompanying pile burning and the continued threat of catastrophic wildfire. As the park attains its natural background state over time, fire loadings would be reduced and the need to conduct prescribed fires and to manage wild fire use also would be decreased. Adverse impacts on air quality would decrease as well.

Mechanical treatment impacts would be the same as Alternatives I and II except for the use of brush clearing machinery, which would be used in areas with vehicle access. Air quality impacts from this type of machinery would be negligible to minor, short- term and beneficial.

Under this alternative, no appreciable irreversible or irretrievable commitments of resources would be associated with air quality.

Mitigation measures for Alternative III are the same as those for Alternative II.

Agency coordination for Alternative III is the same as Alternative I.

Cumulative impacts for Alternative III are the same as those for Alternative I.

Alternative IV

Average annual air emissions associated with the predicted burning actions for Alternative IV were estimated using the FOFEM model, and the results are summarized and compared to Alternative I. With this alternative containing wildland fire use, increased prescribed burning (compared to No Action), and mechanical treatment Level III, this alternative would allow the park to accelerate the rate at which it would be able to meet its resource management objectives related to desired stand structure and density and for the park to attain a natural background state.

The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in Alternative IV in the eight- year period 2002- 2008 based on park burning plans and historical records, respectively, compared with the No Action Alternative.

Table 4-9 Air Emissions Associated with Various Fire Types in Whiskeytown National Recreation Area
Predicted Future Fire Emissions - Alternative 1 (No Action)
Emissions (tons)

Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	1400	431.6	369.5	223.8	4205.4	120.2	43463.3
Wildland Fire Use ¹	0	0.0	0.0	0.0	0.0	0.0	0.0
Wildfire (Best Case)	1	47.7	40.4	23.2	491.1	14.0	4972.7
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	1401	479.3	409.9	247.0	4696.5	134.2	48436.0

¹As Methane

Predicted Future Fire Emissions - Alternative IV (Multiple Strategy Program)
Emissions (tons)

Fire Type	ACRES	PM ₁₀	PM _{2.5}	VOC ¹	CO	NOx	CO ₂
Prescribed Burns ¹	2200	709.7	607.3	366.4	6913.7	197.5	72644.0
Wildland Fire Use ¹	150	43.6	37.4	22.7	425.1	12.1	4294.7
Wildfire (Best Case)	1	0.3	0.3	0.2	3.5	0.1	35.1
Wildfire (Worst Case)	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	251	753.6	644.9	389.3	7342.4	209.8	76973.8

¹As Methane

Under this alternative, there would be short- term, unavoidable adverse impacts to air quality due to the increased use of prescribed burning and the implementation of wildland fire use. As the park attains its natural background state over time, fuel loadings would be reduced and the need

to conduct prescribed fires and to manage wildland fire use also would be decreased. Adverse impacts on air quality would decrease as well.

The use of natural fire in this alternative would reduce the ability to manage smoke impacts in comparison to Alternative II, but with the proactive management of prescribed fire, better control is effected over Alternatives 1 and 3. Smoke impacts of wildland fire use would be adverse to beneficial, short- term, and major.

Some large, unwanted fire events would occur each decade, with declining duration and intensity of associated smoke events over time as fuels are proactively managed and fuel loads are reduced across the park, although this would not occur during the life of this plan.

Under this alternative, no appreciable irreversible or irretrievable commitments of resources would be associated with air quality.

Mitigation measures for Alternative IV are the same as those for Alternative II.

Agency coordination for Alternative IV is the same as Alternative I.

Cumulative impacts for Alternative IV are the same as those for Alternative I, except for the occasions when a wildland fire use fire would burn for a longer period of time and possibly impact areas of the Sacramento Valley.

Conclusion

None of the alternatives would create impairment of the Class 2 airshed values. When properly managed, most of the alternatives would not result in exceedances of the NAAQS for criteria pollutants. Alternative IV, which includes the random natural events associated with wildland fire use, may be constrained by smoke management issues at certain times and in certain locations.

In considering the impacts of the PM_{10} produced by the various alternatives, both the gross amount of emissions along with the ability to manage the emissions under each alternative are important considerations. Alternatives that allow high levels of control over timing and placement of ignitions (e.g., Alternatives I, II, and III) have less impact on air quality than alternatives that produce particulates on a random basis with less opportunity for management control (Alternative IV).

Pile burning related to fuel break construction and prescribed burn unit boundaries would increase over the historical acreage in all alternatives but Alternative III

Long- term effectiveness of the alternatives must also be considered. Assuming that best available control measures (BACM) are applied to all alternatives, and that they can be successfully managed to keep emissions within the NAAQS levels to protect public health, the alternatives that are likely to show decreasing fuel loads and trends of emission production over time should be favored over those that are likely to indicate an increasing rate of emissions due to a slower rate of fuel reduction.

Each alternative show some long- term effectiveness in decreasing emissions over time, though it would be expected that Alternative III, with only modest accomplishments, would begin to rise again over a longer time span than assessed in this plan. Alternatives I and II, with their emphasis on prescribed fire and suppression and mechanical treatment Level 1, would most likely continue to show high levels of emissions for the short- term due to the inability to treat as many acres as are needed to return the park to its natural background state. Alternative IV shows moderate increases in PM_{10} emissions over the other alternatives due to the inclusion of wildland fire use, but also

exercises a great amount of control over the timing and placement of fire events, with most restoration burning occurring under controlled prescribed fire events.

Areas of Special Consideration

Fire management activities and their associated environmental impacts are more limited in areas of special consideration due to both the rare or unique qualities and features of these sites, and the overlap of fire management activities in the areas. For example, rare plants sites are more frequently found in these areas as a result of either limited land use activities or remote access concerns. Also, mineral springs are thought to be less impacted by fire management activities due to their hydrologic nature. More data is needed for a complete understanding of the impacts for each of these areas.

Rare plant sites

Rare plant sites occur throughout the park and in every vegetation community. In addition to the impacts discussed above in the vegetation communities section, rare plants sites may be seen as ecological indicators of ecosystem health and response to fire management activities. More data is needed to understand the connection between rare plant sites and fire management activities.

Mineral Springs

No fire management activities would occur in mineral spring areas. For the most part, these springs occur in lower elevation areas and are strong magnets for wildlife. Also, many rare plants occur in these areas, including *Puccinellia howellii*, or Howell's alkali grass—the plant species in Northern California closest to extinction according to the US Fish and Wildlife Service (Smith 2002).

Old Growth Forests

Impacts to old growth forests are discussed in the vegetation communities section (see mixed conifer and ponderosa pine communities). As a general overview, under Alternative I, the park would consider conducting limited prescribed fires in some old growth stands. Under Alternative II lower intensity impacts to old growth would be more limited, however, fire frequency and intensity is expected to increase, posing a greater risk over time. Alternative III's emphasis on increased prescribed fire would have a beneficial impact on old growth, with the caveat that a vegetation community's response to management ignited fire is thought to be different than that of naturally ignited fire. Though Alternative IV does include increased levels of mechanical treatment, the park's old growth stands would not be considered appropriate locations, primarily due to soil compaction and erosion problems of heavy equipment on decomposed granitic soils. Alternative IV's introduction of wildland fire use would impact old growth forests, and these impacts are discussed in the vegetation section. Impacts would be considered beneficial, major and long-term.

Some sensitive wildlife species are found in old growth areas, including: northern spotted owl, tailed frogs, and pacific fishers. Although research indicated that pacific fishers favor old growth forests, at Whiskeytown they are more frequently observed where people are, generally in lower elevations along the lake and creeks. There have been no formal studies measure abundance and distribution of pacific fishers in Whiskeytown.

The Top of Shasta Bally

For a review of the impacts to the top of Shasta Bally, please review the impacts to the chaparral community discussed earlier in this chapter. In this area of exposed rock and montane chaparral there are numerous rare plants, and very little hazardous fuels. This area, along with other chaparral communities, is a fire adapted community. Alternative IV's wildland fire use

component is expected to be most prominent in this area, due to the high incidences of lighting strikes and the expected elevation creep of fires started below the summit. As a generalized statement, fire in this area is expected to stimulate biodiversity. Suppression activities would only be considered around the communication site structures. Fox sparrows are common in this part of the park.

Riparian Habitats

For a review of the impacts to the park's riparian habitats, please review the impacts to the riparian vegetation community discussed earlier in this chapter. Some wildlife of concern that occur in riparian habitats include the western pond turtle, the foothill yellow legged frog, and the tailed frog. Impacts to these resources are also discussed earlier in this chapter under Wildlife.

Cultural Environment and Special Designations

Archaeological Resources

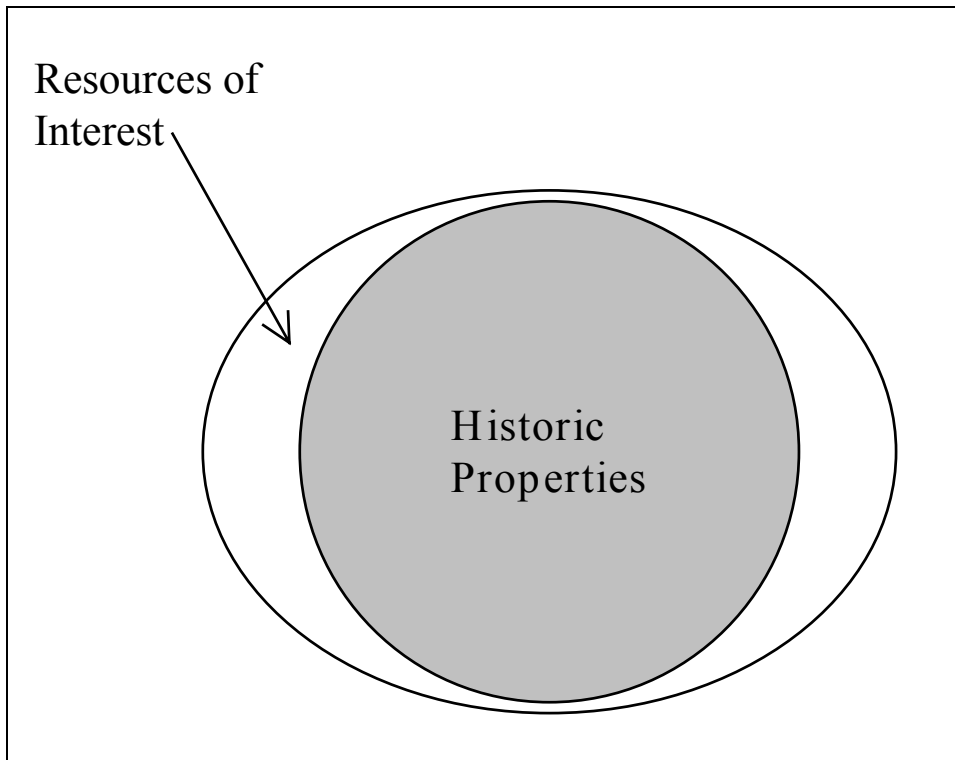
Fire management actions such as prescribed fire, suppression, and mechanical treatments have the potential to impact cultural resources such as archeological sites, structures, ethnographic resources, and cultural landscapes. Museum objects can also be threatened by such actions, both the physical well being of the objects themselves, and the ability to properly catalog and process those objects.

Section 106 of the National Historic Preservation Act requires Federal agencies to consider the impacts of its actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Proper management of museum objects is dictated by 36 CFR 79.

Presently the agencies comprising the U.S. Department of the Interior, including the National Park Service, and the U.S. Department of Agriculture are developing a nationwide Programmatic Agreement with each states' respective Historic Preservation Office, the National Council of State Historic Preservation Offices, and Advisory Council on Historic Preservation. This document would follow procedures outlined in 36 CFR 800.14(b) of Section 106 of the National Historic Preservation Act. Among the core elements of the Programmatic Agreement include professional qualifications, standard protocols for cultural resources compliance for fire management actions, Indian Tribe and public participation, agency review procedures, and inadvertent impacts. The benefit of Programmatic Agreement would be greatly expedited Section 106 compliance review for fire management actions, as well as the establishment of standard protocols for most effectively identifying, evaluating and protecting cultural resources during planned and unplanned fire management actions.

Terms found in Section 106 of the National Historic Preservation Act are used to describe cultural resource significance and impacts in this section. However, it is important to distinguish Historic Properties (as defined above) from *resources of interest*, which are those classes of resources that have some potential to be important, and have the potential to be impaired by the fire management action. While Historic Properties are *de facto* resources of interest, these might also include sites, features, structures or other phenomenon that do not meet National Register of Historic Places criteria of significance, the minimum age requirement, and/or possesses sufficient integrity, but contribute somehow to our understanding of prehistory, history, or traditional lifeways, and could be compromised (*Figure 1. Relationship between Historic Properties and Resources of Interest.*). Each resource of interest is comprised of a set of attributes, called

significant characteristics, which lend importance to that resource. An example of a resource of interest at Whiskeytown are small, sparse flaked stone lithic scatters. Such resources typically have low data potential and diminished integrity due to historic land- use practices, and would generally not qualify as Historic Properties. However, when one considers that much of the Native American archeological resources found at Whiskeytown were heavily impacted during the construction of the reservoir, small, sparse flaked stone lithic scatters command greater importance as sources of information understanding Native American lifeways in the middle reaches of the Clear Creek watershed. As such, these sites deserve consideration when threatened by impacts from fire management actions.



Relationship between Historic Properties and Resources of Interest.

Methodology

NEPA recognizes three types of impacts—direct, indirect, and cumulative. Direct impacts are those that are caused at the same time and place as the action, indirect impacts occur later in time and at a distance, while cumulative impacts are additive. In regard to cultural resources, direct, operational and indirect effect categories are utilized. Direct impacts are those where the fire itself is the cause of the impacts, operational impacts occur as a result of associated operations like line construction or staging, while indirect impacts are ones where fire and/or associated operations result in changes to local context such that cultural resources would be effected. As such, direct and operational impacts for cultural resources are the equivalent of direct impacts under NEPA, while indirect impacts on cultural resources correspond to indirect and cumulative impacts.

One major impediment to cultural resources compliance related to fire management actions is a poor understanding of the nature of direct, operational and indirect impacts. In an effort to remedy this situation, Federal agencies sponsored the preparation of a volume of fire impacts on

cultural resources to be published through the U.S. Forest Service “Rainbow Series” on fire impacts. This document has yet to appear, so a review of existing fire impacts knowledge was prepared and is presented in Appendix C. The appendix broadly summarizes known direct fire impacts on those components that comprise the cultural resources of Whiskeytown (e.g., stone, bone, glass, metal, wood, vegetation), and operational and indirect impacts that could potentially occur as a result of the proposed fire management actions.

NEPA also dictates that potential impacts be considered in regard to type (adverse, beneficial) duration (short- term, long- term, permanent) and intensity. The Section 106 process considers only the adverse impacts upon cultural resources, not potentially beneficial ones. An ordinal scale of impact intensity (negligible, minor, moderate, major) is also foreign to the Section 106 process—impacts are either adverse (when the integrity of the historic property is diminished due to the undertaking) or they are not. Duration is not typically factored when assessing impacts during the Section 106 process. These issues are considered in greater detail below in relation to direct, operational and indirect impacts.

The following measures are employed to assess impacts of fire management actions on cultural resources. Further rationale for each measure is provided in discussions of direct, operational, and indirect impacts that follow.

Type

Adverse: Changes to the significant characteristics of a resource of interest. These changes may be perceptible and measurable, or, in the case of certain archeological and ethnographic resources, imperceptible and psychological.

Beneficial: Changes on or in the vicinity of a resource of interest such that the significant characteristics of the resource are protected against adverse impacts of fire management actions and/or restored to some desired condition.

Duration

Impact duration measurements change by the type of resource being analyzed.

Archeological Resources

Short- term- Adverse: Changes that result in permanent or temporary loss of data potential in the significant characteristics of a resource of interest, but do not manifest for a period of 10 or fewer years following the fire management action.

Short- term- Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 years.

Long- term- Adverse: Changes that result in a permanent or temporary loss of data potential in the significant characteristics of a resource of interest, and manifest in more than 10 years following the fire management action.

Long- term- Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 to 20 years.

Permanent- Adverse: Changes that result in permanent loss of data potential in the significant characteristics of a resource of interest, and manifest immediately following the fire management action.

Permanent- Beneficial: Changes that result in permanent protection to the significant characteristics of a resource of interest from fire management actions.

Structures

Short- term- Adverse: Changes that result in a permanent or temporary loss of data potential in a resource of interest, but do not manifest for a period of 10 or fewer years following the fire management action.

Short-term- Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 years.

Long-term- Adverse: Changes that result in a permanent or temporary loss of data potential in a resource of interest, and are manifest in more than 10 years following the fire management action.

Long-term- Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 to 20 years.

Permanent- Adverse: Changes that result in permanent loss of data potential in a resource of interest, and that are manifest immediately following the fire management action.

Permanent- Beneficial: Changes that result in permanent protection to the significant characteristics of a resource of interest from fire management actions.

Ethnographic Resources

Short-term- Adverse: Temporary changes in the significant characteristics of a resource of interest that do not disrupt the cultural traditions associated with that resource for a noticeable period. This period would vary by resource type and traditional practitioners.

Short-term- Beneficial: Temporary changes in the significant characteristics of a resource of interest that enhance or maintain cultural traditions for a period of no more than one year. For example, burning leaf litter in an oak grove to facilitate acorn collection.

Long-term- Adverse: Temporary changes in the significant characteristics of a resource of interest for a noticeable period. This period would vary by resource type and traditional practitioners.

Long-term- Beneficial: Temporary changes in the significant characteristics of a resource of interest that enhance or maintain cultural traditions for a period of one to 10 years. For example, clearing fuel from a spiritual site to prevent intense fire behavior.

Permanent- Adverse: Permanent changes in the significant characteristics of a resource of interest that result in a loss of cultural traditions associated with that resource.

Permanent- Beneficial: Permanent changes in the significant characteristics of a resource of interest that have the potential to enhance or maintain cultural traditions in perpetuity.

Cultural Landscapes

Short-term- Adverse: Temporary alteration of the significant characteristics of a resource of interest for a period lasting no more than 10 years. Short-term alterations would almost always involve living vegetation.

Short-term- Beneficial: Temporary protection, restoration, or maintenance of the significant characteristics of a resource of interest for a period lasting no more than 10 years.

Long-term- Adverse: Temporary alteration of the significant characteristics of a resource of interest for a period lasting more than 10 years. Short-term alterations would almost always involve living vegetation.

Long-term- Beneficial: Temporary protection, restoration, or maintenance of the significant characteristics of a resource of interest for a period lasting more than 10 years.

Permanent- Adverse: Permanent alteration of the significant characteristics of a resource of interest. Permanent alterations would often encompass both living vegetation and other landscape features.

Permanent- Beneficial: Permanent protection, restoration, or maintenance of the significant characteristics of a resource of interest.

Museum Objects

Short-term- Adverse: Backlogs in the processing of archival and spatial data that do not exceed one year.

Long-term- Adverse: Backlogs in the processing of archival and spatial data that range from one to five years.

Permanent: Backlogs in the processing of archival and spatial data that exceeds five years.

Intensity

In this analysis, intensity of impact is measured relative only to adverse resource impacts.

Archeological Resources

Negligible: No or barely perceptible and changes to the significant characteristics of a resource of interest.

Minor: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a minor percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological resources containing a high percentage of resources of interest with low vulnerability to the impacts of fire management actions and/or possessing subsurface components.

Moderate: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a moderate percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological sites containing a moderate percentage of resources of interest with low vulnerability to the impacts of fire management actions and/or possessing subsurface components.

Major: Perceptible changes to the significant characteristics of a resource of interest, and those changes inhibit interpretive potential of a major percentage of the significant characteristics. Resources prone to impacts in this category might include archeological sites containing a large percentage of resources of interest with high vulnerability to the impacts of fire management actions.

Structures

Negligible: Barely perceptible and not measurable changes confined to a single resource of interest or contributing element of a larger National Register district. Changes do not adversely effect significant characteristics.

Minor: Perceptible and measurable changes to a single resource of interest or contributing element of a larger National Register district. Changes do not adversely effect significant characteristics.

Moderate: Perceptible and measurable changes in the significant characteristics of a single resource of interest or small group of contributing elements in a larger National Register district.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a single resource of interest or large group of contributing elements in a National Register district.

Ethnographic Resources

Negligible: Barely perceptible and not measurable changes to a resource of interest.

Minor: Perceptible and measurable changes to a resource of interest. For example, an important oak grove burns during a wildland fire, but not at a time or intensity that impairs acorn production or collection.

Moderate: Perceptible and measurable changes in the significant characteristics of a resource of interest. For example, an important oak grove burns during the fall, consuming a high percentage of acorns and killing a couple of productive trees.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a resource of interest. For example, an important oak grove burns during a severe wildland fire, killing the vast majority of productive trees.

Cultural Landscapes

Negligible: Barely perceptible and not measurable changes to a resource of interest.

Minor: Perceptible and measurable minor changes to a resource of interest. For example, a severe wildland fire kills a highly visible concentration of non-contributing oak trees located on the boundary of a rural historic cultural landscape.

Moderate: Perceptible and measurable moderate changes in the significant characteristics of a resource of interest. For example, a fire crew cuts down several contributing fruit trees in a rural historic cultural landscape in preparation for a prescribed burn.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a resource of interest. For example, extreme fire behavior and aggressive suppression action destroys a large number of contributing elements within a rural historic cultural landscape.

Museum Objects

Not applicable

A summary of direct, operational and indirect impacts is presented below, followed by an explanation of the measures chosen for the types, duration and intensity of impacts listed above.

Direct, Operational and Indirect Impacts

Direct Impacts

Cultural resources vary in terms of their susceptibility to direct fire impacts. For example, obsidian hydration rinds are generally impacted at temperatures in excess of 100 to 150° C, dimensional lumber ignites at 350° C, glass melts at around 500° C, and cast iron at 1400° C. Duration of heating is less well understood, but in general, the longer a resource is exposed to heat, the greater the likelihood of damage. Fire can result in the complete elimination of an artifact or feature (e.g., through consumption) or can alter attributes of an artifact or feature such that important research (e.g., obsidian hydration rinds, residues on pottery, bone burning), traditional (e.g., Native American spiritual sites) or other values are impacted.

Fires tend to burn in a complex manner depending on fuels, weather and terrain (Ryan and Noste 1985). Fire intensity is generally greater under conditions of heavier fuel (e.g., dead and down timber, brush fields), low fuel moisture, high air temperatures, high winds, low humidity and/or rugged terrain. It is the behavior of a fire (ground, surface, and crown) and proximity to a cultural resource that would determine the amount and type of damage that could occur. While running surface fires and crown fires reach extreme temperatures (500 to 1500° C) and have high energy release rates, relatively little of that heat is directed towards the surface of the ground, and ground fires can result in long duration heating (400 to 700° C) within the upper 15 cm. of the soil profile. Only under rare conditions (e.g., burning tree roots) would elevated temperatures penetrate more deeply beneath the ground surface. Ground and creeping and active surface fires are usually associated with prescribed burns and wildland fire use, whereas running surface and crown fires occur primarily during wildland fires. Very generally, cultural resources located above the ground surface (e.g., rock imagery panels, historical structures) are most vulnerable to direct fire impacts during crown and active surface fires, while ground and creeping surface fires threaten those found at or just below the ground surface (e.g., archeological sites).

Operational Impacts

Operational impacts to cultural resources are most likely to occur as a result of fire management actions associated with prescribed burns, wildland fire use, wildland fires and mechanical thinning. The operational impacts on cultural resources have been quantified in relatively few cases. However, several generalizations can be made:

Impacts resulting from the operation of heavy equipment on and in close proximity to cultural resources would correlate directly with the nature and extent of the disturbance, nature of local sediments, and nature and extent of cultural resources.

With the exception of those that result in more intense fire behavior (e.g., slash piles, firing techniques), impacts resulting from operational impacts would generally be restricted to the displacement, breakage and/or destruction and looting of cultural resources. In this sense, operational impacts tend to be less encompassing than direct impacts. For example, an obsidian projectile point displaced by construction of a fire line would probably retain its hydration rind, morphology, and other attributes.

Except in rare situations, operational impacts are likely to be most pronounced on cultural resources found on and near the ground surface.

Operational impacts would be most likely to occur, and at the greatest intensity, during wildland fires. This is due primarily to the fact that such actions are often carried out with little or no pre-planning and without consultation or supervision by a cultural resource specialist.

Indirect Impacts

Indirect impacts are perhaps the most elusive of all, since the impacts may be delayed and incremental. The potential for indirect impacts would relate strongly to the context in which a cultural resource is found, the nature of that resource, and the type and extent of the disturbance activity. In most cases, intense fire behavior and major suppression efforts associated with wildland fires would render cultural resources vulnerable to indirect impacts soon after the event. Indirect impacts may not be as pronounced following managed actions such as prescribed burns or mechanical thinning, but can, given enough time, have equally adverse consequences.

Type of Impacts

In general, direct impacts of fire management actions on cultural resources would be adverse. This is particularly true of archeological resources, structures, and museum objects. While direct fire impacts can also adversely impact ethnographic resources and cultural landscapes, fire can also be used to restore, enhance and maintain them. For example, in regard to ethnographic resources, some plants important for basket making benefit from the proper application of fire (Anderson 1999). In cultural landscapes with a vegetation component, fire can be applied to replicate and maintain historic scenes. Adverse direct impacts are more likely to occur during extreme fire behavior such as wildland fires, although cultural resources with high vulnerability to fire are susceptible to low intensity burns often associated with prescribed fire and wildland fire use.

Operational impacts of fire management actions on cultural resources would, in most cases, be adverse. However, the degree of impact depends greatly on the nature of the operation and the cultural resource or resources in question. Adverse operational impacts are of particular concern during and after wildland fire events. With proper planning, operations can also be used for beneficial purposes. For example, mechanical thinning can effectively remove hazardous fuels from and in the vicinity of cultural resources, as well as restore, enhance or maintain ethnographic resources and cultural landscapes, in cases where the risk of direct impacts is too high.

Finally, the indirect impacts of fire management actions generally adversely affect cultural resources, especially those that follow high intensity wildland fires.

Duration of Impacts

With respect to archeological resources, structures and cultural landscapes, short and long- term impacts related to fire management actions are distinguished based on the number of years (10 and 20, respectively) before impacts manifested following the action. These numbers were selected based on the assumption that some form of fire management action (prescribed fire, mechanical thinning, wildland fire use) would be carried out within the same area within 10 years of the previous action (presuming about 3500 acres are treated each year, as estimated under the preferred alternative). As such, previously recorded resources would be revisited and pertinent attributes documented and/or preservation measures taken. Previously undocumented cultural resources might be recorded prior to the subsequent undertaking, and appropriate management actions implemented. Impacts of short and long- term duration differ from those of permanent duration, where significant characteristics of a resource of interest are irrevocably compromised during the action. Intervals utilized for ethnographic resources and museum objects are configured somewhat differently given variations in the use and nature of these resources.

The duration of direct, operational and indirect impacts on fire management actions is influenced strongly by the nature of the action and fire intensity. For example, a high intensity wildland fire would tend to result in more adverse permanent impacts than a low intensity prescribed burn. Likewise, a suppression effort using heavy equipment has a higher likelihood of more adverse operational and indirect impacts than one with hand lines. Adverse impacts resulting from fire management actions vary in regard to timing. For example, some archeological resources would be totally consumed by the burn, while others would be modified such that deterioration would occur more rapidly following the burn. Ethnographic resources and cultural landscape features may recover slowly following fire management actions. However, fire can also be used to protect certain cultural resources by reducing adjacent fuel loads, or, in the case of ethnographic resources or cultural landscapes, restore, maintain, and/or enhance them.

Short- term, long- term, and permanent impacts on museum objects was determined based on the fact that fire management actions would require a substantial amount of fieldwork, compilation of a tremendous amount of data, and that Whiskeytown lacks a full- time curator.

Intensity of Impacts

The intensity of direct fire impacts is difficult to quantify. This is due in part to the poor understanding of these impacts, as well as the apparent differential vulnerability of the various cultural resource classes. Because of this, it is probably better to consider potential direct impacts to individual components of a particular resource class (e.g., flaked stone, ground stone, bone, shell in a Native American village) rather than the resource class as a whole (e.g., lithic scatters, villages, trash scatters, mines for archeological resources). As noted, however, even within individual components, direct fire impacts differentially impact various attributes of a particular artifact or feature type. For example, potential direct fire impacts on an obsidian artifact include alteration of the obsidian hydration rind, inability to chemically source, breakage, melting, discoloration, and elimination of organic residues, each of which can occur at different temperatures and/or duration of exposure.

Ideally, an assessment of the intensity of potential direct impacts on cultural resources at Whiskeytown would be conducted in conjunction with fire temperature data for each fuel model/vegetation community, detailed fire history studies, and accurate inventory of the types and distribution of cultural resources found in the unit. Unfortunately, this is not the case. While computer models predicting the intensity and severity of fire behavior based on a number of variables are available, predicting direct fire impacts on cultural resources from the outputs is not well developed. For example, most experiments measuring the impacts of fire on cultural resources utilized temperature as the agent of change, while computer models provide estimates

of fire line intensity in non-comparable British Thermal Units (BTUs). As noted in the Affected Environment Chapter, accurate fire history data are available only for the past 30 years, less than 10% of the unit has been inventoried for cultural resources, few archeological excavations have been conducted, and the thick vegetation cover that blankets much of the unit has certainly influenced survey results.

Still, some generalizations can be put forth with regard to evaluating potential direct fire impacts. In most cases, the greater the fuel load, the more intensely a fire is likely to burn (DeBano et al. 1996). Thirteen fuel models have been defined in North America (Anderson 1981), 11 of which are found at Whiskeytown. These models, which can be divided into grass and grass-dominated, chaparral and shrub field, timber litter and slash categories, vary in regard to average fuel load and fire line intensity (see the table below). Unfortunately, the distribution of these fuel models is not well established at Whiskeytown, nor are on-the-ground determinations of actual fuel loads. Still, various estimates, combined with outputs generated by fire behavior computer models, provide a means of ranking the various fuel models in terms of fire intensity, and therefore, likelihood of impacting cultural resources. These can be expressed as ranges, varying from benign fire behavior that might be expected in association with prescribed burns, to extreme conditions that occur during wildland fires. Those fuel models that are most widespread (e.g., chaparral and timber litter) at Whiskeytown can exhibit intense fire behavior, and contain the greatest percentage of the recorded cultural resources (see the table below). While temperature thresholds above which various classes or attributes of cultural resources can be adversely affected are not readily identifiable, it can be assumed that highly vulnerable data like wooden structures and features and obsidian hydration rinds have the potential to be impaired at even the lowest fire intensities in most fuel models.

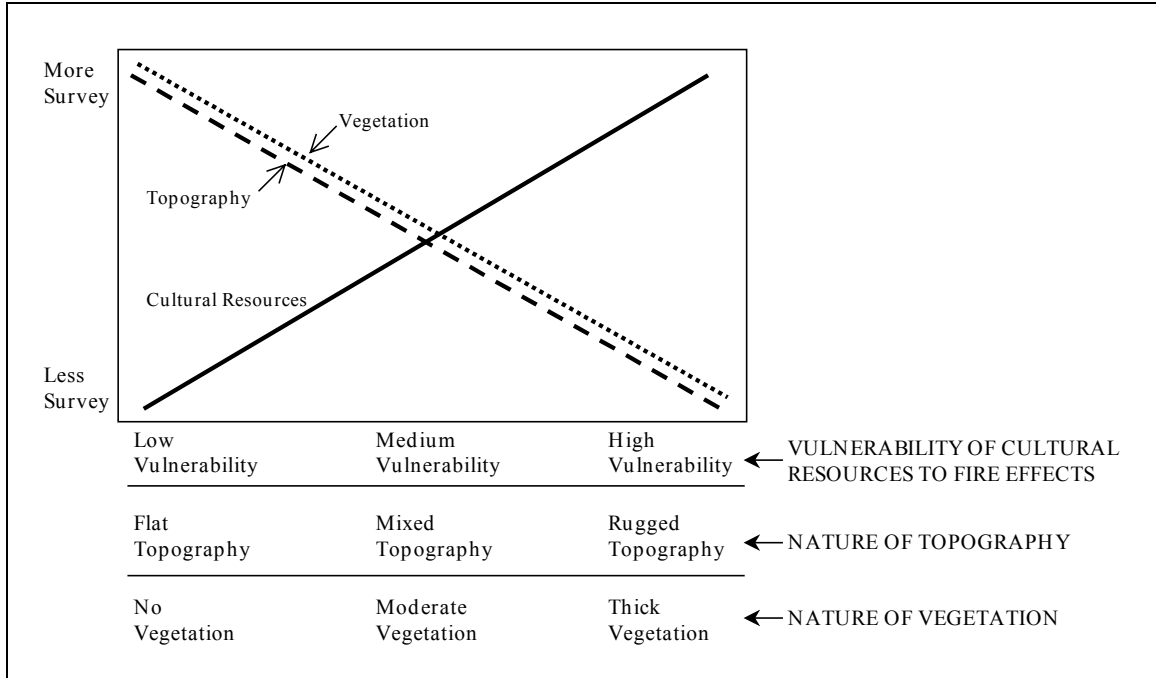
Table 4-10 Characteristics of the Fuel Models at Whiskeytown.

Fuel Complex	Fuel Models	Acres	Number of Archeological Resources	1 to 100 Hour Fuel Loading
Grass and Grass-Dominated	1, 2, 3	953	11	0.74 to 3.50
Chaparral and Shrub Fields	4, 5, 6	15,959	96	1.50 to 11.02
Timber Litter	8, 9, 10	21,096	149	3.48 to 10.02
Logging Slash	11, 12	13	0	11.52 to 34.57

Past fire activity is relevant in assessing potential direct impacts in that fuel loads can be influenced by the frequency of fire. For example, long-term research in mixed conifer forests of the Sierra Nevada demonstrated a significant reduction in fuel loads for up to 10 years following prescribed burns (Keifer 1998). At least 61 of the recorded cultural resources at Whiskeytown lie within areas that have burned once or more in wildland or prescribed fires since the 1940s. Inferences about past fire frequency can also be drawn from topographic variables such as aspect and slope. For example, fire frequency is usually greater on steep, south facing slopes than other orientations.

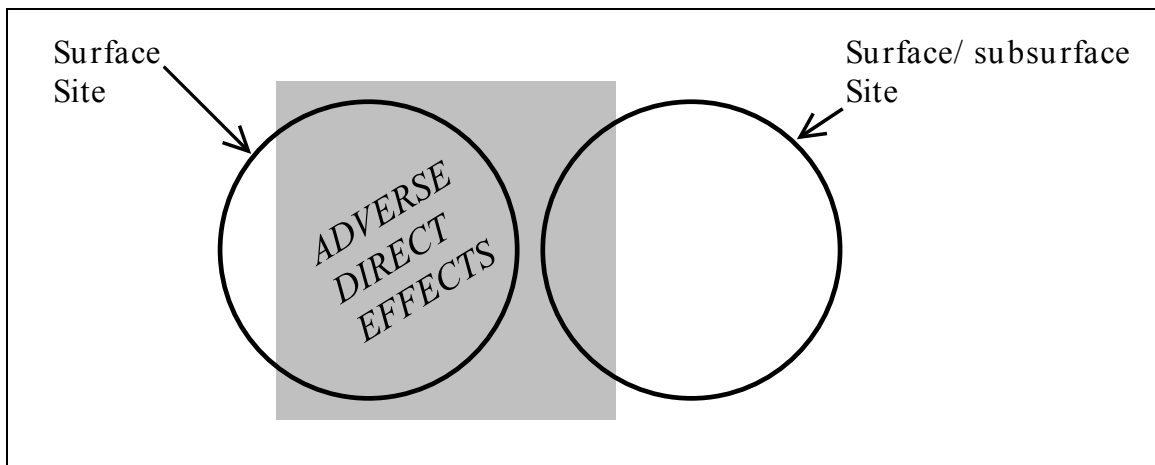
The accuracy of previous cultural resources surveys at Whiskeytown has probably been influenced by a combination of thick vegetation and rugged topography. Ironically, those areas that are most easily traversed (low gradient topography, sparse vegetation) would usually support less intense fire behavior than steep and/or heavily vegetated locations (Figure 2). While areas with low topographic gradient were probably the most attractive for settlement, some activities (e.g., mining) were carried out without regard to such considerations. The implication is that it would often be difficult to locate and adequately document cultural resources in areas of thick

vegetation and/or steep topography, and that such resources would be highly vulnerable to direct fire impacts.



Relationship between survey coverage, vulnerability of cultural resources to fire impacts, topography, and vegetation.

The volume or extent of a cultural resource vulnerable to direct fire impacts also merits consideration. As noted, except under special circumstances, direct fire impacts would generally be restricted to those cultural resources found above, on, and slightly below the ground surface. As such, all else being equal, the classes and attributes of cultural resources found exclusively on or near the ground surface are prone to have a greater percentage of their number adversely impacted by direct fire impacts than those resources with a combination of surface and subsurface material. This is significant because cultural resources generally considered to have high data potential, such as Native American villages with subsurface components, may actually have a far lower percentage of artifact classes or attributes exposed to direct fire impacts than a lithic scatter, often considered to have low data potential, that is restricted to the ground surface (Figure 3). While it is the village that would probably receive the greatest amount of attention in regard to a planned or unplanned fire management action, it is the lithic scatter that has the potential to undergo the greatest intensity of impact.



Susceptibility of cultural materials in surface and surface/subsurface contexts to direct fire impacts.
Open circles reflect the full range of artifact classes/attributes represented at each site type, and the amount of overlap with the shaded circle represents the amount or percentage of artifact classes/attributes vulnerable to adverse impacts.

Determining if and/or to what extent a cultural resource has subsurface components is best accomplished through invasive (e.g., excavation, auguring) or non- invasive (e.g., remote sensing, cut bank inspection) means. As discussed in Chapter 3, relatively few of these studies have been carried out at Whiskeytown. While people do intentionally and unintentionally bury cultural materials (e.g., trash dumps, burials), it is geomorphologic processes that dictate whether a given cultural resource is likely to have a subsurface component. In general, toe slopes, foot slopes, and terraces would have greater accumulations of colluviums and alluvium than summits and side slopes, from which these sediments are eroding. Owing to the highly erosive geology, these processes are particularly pronounced in the Whiskeytown area. In the absence of invasive or non- invasive investigations, inferences about the presence and extent of subsurface components can be drawn based on the geomorphological context in which a resource is found.

Mitigation of Impacts

NEPA dictates that all mitigation measures in response to proposed actions be identified, their effectiveness measured, and impacts assessed if the proposed actions were to proceed without mitigation. This analysis differs from Section 106 in that it does not suggest that the level of effect is similarly reduced. Although adverse impacts under Section 106 may be mitigated, the impacts remain adverse.

Standardized, detailed mitigation measures for fire management actions at Whiskeytown would be presented in the Cultural Resource Component of the Fire Management Plan. The contents of the Cultural Resource Component of the Fire Management Plan are dictated by the forthcoming programmatic agreement for fire management actions discussed early. The programmatic agreement would be accompanied by a companion set of guidelines, in which appropriate mitigation measures are identified for the various types of fire management actions. Each respective Historic Preservation Office, the National Council of State Historic Preservation Offices, and Advisory Council on Historic Preservation would ratify these mitigation measures as acceptable, when used appropriately, for mitigating the impacts of fire management actions on cultural resources.

Mitigation of impacts to cultural resources against the impacts of fire management actions involves a combination of knowledge of the potential direct, operational and indirect impacts of known or suspected resources, appropriate resource inventory methods, and protection and treatment measures. A somewhat standardized approach to this has been developed, through consultation with the California State Historic Preservation Office, and implemented at Whiskeytown. The Cultural Resource Component of the Whiskeytown Fire Management Plan would probably mirror certain aspects of that document.

Appropriate mitigation measures can be conveniently divided into pre- action, during- action, and post- action categories. Those that would be employed at Whiskeytown include:

Pre-Action Standards

Cultural resources would be considered during all fire management planning efforts.

Fire management personnel and other staff would receive annual training on cultural resources and fire management actions.

All cultural resources would be evaluated with respect to hazardous fuel loads. As needed, fuel loads would be reduced using methods commensurate with avoiding or minimizing adverse impacts. Maintaining light fuel loads on and in close proximity to cultural resources would be emphasized.

All areas slated for ground disturbing activities would be subjected to pre- action field surveys. This includes areas likely to be disturbed during future wildland fires.

Pre- burn survey would be conducted prior to all prescribed burns and Wildland fire use as dictated by resource distribution and vulnerability, vegetation and topography, and expected fire behavior.

Consultation with local Native American communities would continue to occur in the context of fire management actions. Spiritual sites and important plant communities would be identified and appropriately managed for preservation, maintenance, and/or enhancement.

Computer and other databases containing cultural resources data would be created and maintained, and made available to fire management personnel in the event of emergencies.

Cultural resources specialists from adjacent land management agencies would be consulted in order to coordinate mitigation efforts prior to planned and unplanned fire management actions.

Appropriate cultural resources monitoring protocols would be established and implemented.

Potential research opportunities to study the impacts of fire management actions on cultural resources would be identified.

During Action Standards

A cultural resource specialist or resource advisor would be present during all fire management actions where recorded and unrecorded resources of interest are considered at risk. Additional survey would be conducted on an as- needed basis.

Observations of fire behavior and other variables would be made with respect to recorded cultural resources and/or areas with high probability of containing unrecorded cultural resources.

Cultural resources data would be shared with fire management personnel as needed to avoid or minimize adverse impacts.

A cultural resource specialist or resource advisor would educate fire management personnel about cultural resources and the potential impacts of fire management actions.

Post Action Standards

The post- action condition of all recorded cultural resources would be assessed. Resources requiring stabilization or other treatment would be mitigated.

As appropriate, post- action survey would be conducted in previously surveyed and un- surveyed areas. Previously unrecorded cultural resources would be assessed for condition, and stabilization and other protection needs.

Monitoring and research data would be compiled, evaluated, and used to help refine cultural resource compliance for fire management actions.

Issues and Impacts Common to All Alternatives

Prescribed Fire

Direct Impacts

Prescribed burns offer the cultural resource specialist the opportunity to attempt to locate, evaluate and mitigate cultural resources prior to the undertaking. Potential mitigation measures are described above. In cases where excessive fuel loads, topography or other restrictions place constraints on the amount and/or adequacy of pre- burn survey, it is highly likely that adverse direct impacts could occur. The ability to conduct pre- burn inventories allows the cultural resources specialist to quantitatively and spatially document fuel conditions and other variables that can be used to direct post- burn survey and more meaningfully assess damage to cultural resources that could not be documented and/or mitigated prior to the burn. While prescribed burns as large as 1,000 acres can be implemented, wildland fires have the potential to grow much larger and encompass many more cultural resources.

Prescribed burns are implemented under specific conditions with the intent of achieving specific objectives such as ecosystem restoration, resource protection, and hazard fuel reduction. As

such, it is possible, through varied timing or operational procedures (e.g., heading or backing fire) to achieve lower or higher fire intensities to accomplish those objectives. In the context of cultural resources management, a low intensity fire might be utilized on or immediately adjacent to a particular cultural resource, while a high intensity fire could significantly reduce hazardous fuels surrounding the resource. Prescribed burns are implemented at times when the likelihood of escape is low, thereby minimizing potential impacts to those cultural resources in close proximity to a burn unit.

Because prescribed burns are implemented under controlled conditions, the cultural resource specialist would often have the opportunity to monitor fire behavior and the effectiveness of mitigation measures during the burn.

Operational Impacts

Most operational activities, such as line construction, associated with prescribed burns are conducted in advance of the actual burn. This affords the cultural resources specialist the opportunity to survey those locations prior to any disturbances, and make necessary adjustments in order to avoid or minimize operational impacts. The cultural resource specialist can also brief fire personnel on the proper protocol in and around cultural resources.

Because prescribed fires are unlikely to escape the boundaries of the burn units there is little chance of suppression- related operational impacts. In the event of an escape, however, the presence of a cultural resource specialist, along with pre- burn contingency planning, would allow for a greater chance to mitigate or minimize potential adverse operational impacts. Ground disturbances associated with mop- up and rehabilitation are usually few or none following prescribed burns. As discussed below, this contrasts sharply with suppression during wildland fires.

Indirect Impacts

The benefit of pre- burning planning allows the cultural resources specialist to account for potential indirect impacts. For example, if high tree mortality is a concern following the burn, efforts can be taken to reduce the number of trees in proximity to a cultural resource. Some indirect impacts like erosion are exacerbated by intense fire behavior, the type that is unlikely to occur over large areas during prescribed burns.

Wildland fire and Suppression

Direct Impacts

Due to often extreme fire behavior, the direct impacts of wildland fires on cultural resources can be substantial, including adverse, permanent damage. Wildland fires range from extremely small (<0.1 acre) to thousands of acres, and those that grow to substantial size are often driven by a combination extreme weather conditions and heavy fuels. Extremely high fire temperatures can be expected, with the implication that even the most durable cultural resources are vulnerable to major, permanent damage. Large fires would often encompass a high number of cultural resources.

As they are unplanned events, cultural resource specialists rarely have the luxury of benefits conveyed by pre- planning efforts during wildland fires. For example, because a relatively small percentage of Whiskeytown has been inventoried for cultural resources, it is highly likely that wildland fires would occur in areas that lack or have few recorded cultural resources.

Information regarding direct impacts would in most cases be obtained during the post- burn phase, and involve evaluating those impacts on resources for which no pre- burn condition data were available. At present, the principle post- wildland fire funding source (Burned Area Emergency Rehabilitation) prohibits the use of those funds to perform post- burn inventory beyond areas impacted by suppression actions. The need for substantial post- wildland fire

inventory can impact the ability to complete compliance for planned fire management and other projects.

Operational Impacts

Operational impacts associated with wildland fire suppression can often be extreme. The act of constructing fire lines, heli- spots, staging areas, mopping- up and other ground disturbing processes can have tremendous impacts on cultural resources. Even with MIST techniques described in Chapter 2, the placement of fire lines and related phenomenon can be quite unsystematic when compared to planned fire management actions. Although the use of heavy equipment for fire suppression is prohibited unless authorized by the Whiskeytown superintendent, it is a standard tool for agencies charged with fire management on adjacent lands, and would almost certainly be employed in cases where life or property was at risk.

Large numbers of personnel, from varied backgrounds, are present at any substantial fire. Crews are often spread across a vast area, and their activities difficult to monitor by one or very few resource advisors. Cultural resource looting and vandalism can potentially occur during wildland fire events.

Indirect Impacts

Due to high intensity fire and extensive disturbances related to suppression, indirect impacts related to wildland fires could be adverse. For example, impacts from erosion are typically pronounced in situations where most or all of the fuel has burned, and when soil permeability is reduced. Tree mortality can be very high following wildland fires, creating potential long- term cultural resource management concerns. With improved ground visibility, cultural resources may be at greater risk from looting. As noted above, these problems become even more acute when one considers that sources of funding for post- burn inventory are not readily available.

Mechanical Treatment and Shaded Fuel break System

Direct Impacts

Although fire itself is not technically a component of mechanical treatments, prescribed burning of vegetation piles would be utilized. Fuel loads in these piles would be substantial, would tend to burn at very high intensities, and any cultural resources found in proximity would almost certainly suffer direct impacts. With the ability to pre- plan, the cultural resource specialist can ensure that piles are not created on or near cultural resources. Wildland fires started by machinery might lead to severe fire behavior and major, permanent adverse resource impacts.

Operational Impacts

Operational impacts present the greatest concern in regard to the potential impacts of mechanical treatment. Ground disturbance, particularly that associated with mechanical level 2 and 3 treatments, could result in substantial impacts to cultural resources. However, mechanical treatments offer the benefit of pre- planning in that the location(s) of ground disturbance can be specifically delineated, and known cultural resources avoided. In the event that an area cannot be subjected to adequate pre- burn survey due to thick vegetation, a cultural specialist could monitor the mechanical treatment for cultural resources that become exposed. Likewise, less intensive mechanical treatments can be employed in highly sensitive areas. While looting by fuels crews is also a concern, these impacts could be minimized through a combination of education and avoiding known resources.

Indirect Impacts

A variety of indirect impacts could arise as a result of mechanical treatments. Again, these are probably of greatest concern with mechanical level 2 and 3 treatments. The use of heavy equipment could result in soil compaction, and potential soil erosion on and near cultural resources. The act of thinning vegetation on or near cultural resources might leave them

vulnerable to looting. Again, however, the ability to perform pre- treatment survey means that equipment can be excluded from or near cultural resources and vegetation can be strategically left in place to discourage looting. Mechanical treatments also offer the potential benefit of reducing fuel loads in proximity to cultural resources and restoring and/or maintaining historical scenes associated with structures and cultural landscapes, especially in situations where it is not desirable or possible to accomplish these tasks with the direct application of fire.

Wildland Fire Use

Direct Impacts

The potential for direct impacts on cultural resources from wildland fire uses is probably similar to that for prescribed fires. However, wildland fire use differ in that cultural resource specialists are usually not afforded the opportunity to locate and assess cultural resources prior to the burn. Also, in cases where survey is conducted in anticipation of the spread of the wildland fire use, it is often done so at the expense of compliance for other projects. Relatively little survey for cultural resources has been conducted in those portions of FMU- 2 where wildland fire use would be allowed under Alternative IV.

Fire behavior associated with wildland fire use would probably be similar to that anticipated during prescribed burns. However, because the timing of wildland fire use is largely random, more intense fire behavior could occur in conjunction with a rapid weather change. Impacts to cultural resources in that situation would probably be major and permanent.

Operational Impacts

Operational impacts associated with wildland fire use might potentially occur before, during and after the event. Potential wildland fire use zones would be created through the construction of shaded fuel breaks and improvement of natural features. These actions would afford the cultural resource specialist the opportunity to conduct pre- action survey and propose appropriate mitigation strategies. The same might not be true if a wildland fire use was not achieving desired resource goals and required suppression. In such a circumstance, potential operational impacts would be similar to those that result from the suppression of wildland fires, though perhaps at a lesser scale.

Indirect Impacts

Depending on fire behavior and operational activities, indirect impacts resulting from wildland fire use should vary between those associated with prescribed burns and wildland fires.

Fire Information and Education

Impacts associated with fire information and education would largely be beneficial, although highly dependent on the nature of the fire management action. Pre- planned events such as prescribed fires and mechanical treatment provide the opportunity to demonstrate the effectiveness of cultural resources compliance to local Native American communities and the interested public. During unplanned events, such as wildland fires and wildland fire use, time for effective communication is often more limited and can be more controversial since resources are often damaged. As noted in Chapter 3, the Wintu community has expressed interest in working more closely with Whiskeytown fire management staff, and this relationship would be cultivated more quickly and effectively in association with well- planned actions.

Fire cache relocation and park headquarters administration building construction

Direct Impacts

The construction of a new fire cache at Oak Bottom would have no direct impacts on cultural resources. However, relocating fire management personnel to a more centralized location would allow for faster response time to cultural resources in the event of wildland fires. The new cache would be significantly closer to two of the most significant cultural resources—Tower House

historical and archeological districts—at Whiskeytown. Rebuilding a new administrative building at park headquarters would not have any measurable impacts on cultural resources, the entire compound area was bulldozed and leveled in the late 1950s by the Bureau of Reclamation to provide for a vehicle yard. Any cultural resources that may have been at this site have been disturbed and provenience has been lost.

Operational Impacts

Operational impacts associated with the construction of the new fire cache are unlikely to occur. The Oak Bottom and park headquarters compound are developed areas and have been surveyed in their entirety - - no cultural resources have been documented at or in the vicinity of the proposed locations.

Indirect Impacts

No adverse or beneficial indirect impacts are anticipated with the construction of the new fire cache. Long term beneficial impacts can be anticipated through the construction of a new park administrative building in the park headquarters compound. The current museum collection is located in a temporary structure with no foundation. It is anticipated that the museum collection would be incorporated into the new park administration building.

Summary by Alternatives

Alternative I

Actions included in Alternative I include up to six prescribed burn projects encompassing up to 1400 acres/year, 15 mechanical level 1 projects covering up to 275 acres/year, 1150 acres of shaded fuel breaks and a suppression program. The fire cache would be relocated to Oak Bottom, however, no new construction of an administration building at park headquarters would occur. Among the beneficial impacts of this alternative are the ability to pre-plan for prescribed burns, mechanical treatments and shaded fuel break construction and maintenance. On the other hand, at the proposed treatment level, reduction of hazardous fuels would take several decades, increasing the possibility that high severity wildland fires could occur and result in major and permanent adverse impacts to cultural resources.

Alternative II

Actions associated with Alternative II include up to 10 prescribed burn projects encompassing up to 3000 acres/year, six mechanical level 1 projects covering up to 80 acres/year, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. Beneficial impacts of this alternative include the ability to pre-plan for prescribed burns and mechanical treatments. On the other hand, heavy reliance on prescribed burning means that those cultural resources vulnerable to direct fire impacts could be adversely impacted in situations where adequate pre-burn survey and/or mitigation could not be employed. The rate of treatment in Alternative II improves upon that proposed for Alternative I.

Alternative III

Actions associated with Alternative III include up to seven prescribed burn projects encompassing up to 250 acres/year, 12 mechanical level 1 and 2 projects covering up to 450 acres/year, 1400 acres of shaded fuel breaks, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. As it does little to reduce overall fuel loads over time, this alternative has the potential to result in major and permanent damage to cultural resources. Focusing on suppression merely delays the inevitable fact that flammable vegetation would eventually burn, likely with high intensity, and a multitude of adverse operational and indirect impacts could potentially arise.

Alternative IV

Actions associated with Alternative IV include up to 10 prescribed burn projects encompassing up to 2200 acres/year, 20 mechanical level 1, 2, and 3 projects covering up to 640 acres/year, 1150 acres of shaded fuel breaks, up to 150 acres/year of wildland fire use, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. Under this alternative, a

substantial number of projects would be subjected to pre- planning for cultural resources compliance, and a mix of prescribed fire and mechanical treatments would be employed. Wildland fire use would be allowed, and could potentially result in adverse impacts to cultural resources, although these would encompass a relatively small acreage in any given year. As the most aggressive alternative at combating hazardous fuel loads, Alternative IV would more quickly reduce the chances of adverse impacts associated with wildland fires and wildland fire suppression.

Social Environment

Compatibility with Land Use Plans

Methodology

This section examines local agreements, and the fire plans of adjacent landowners and responsible fire management agencies, and assesses the potential impacts of each of our alternatives on the plans. All the lands adjacent to Whiskeytown are protected by California Department of Forestry and Fire Protection (CDF), known as State Responsibility Area (SRA). CDF has developed a strategic wildland fire defense plan for the Middle Creek Watershed 1994, which covers lands adjacent to our east boundary. The Western Shasta Resource Conservation District (WSRCD) has developed a Strategic Fuels Reduction Plan for the Lower Clear Creek Watershed (1999), which covers adjacent lands to our southeast. WSRCD is also developing a plan for Upper Clear Creek Watershed, which covers lands to our north. The Bureau of Land Management, Redding Area, developed a Fire Management Planning document (1997), which describes fire management goals for adjacent lands in areas all around Whiskeytown.

The three direct protection entities of Shasta and Trinity Counties, Whiskeytown National Recreation Area, Shasta- Trinity National Forest (USFS), and Shasta- Trinity Unit (CDF) have an interagency Operating Plan for Fire Suppression. CDF also has developed a California Fire Plan (1999), which establishes state goals and objectives for fire management.

The land use plans above emphasize: interagency cooperation, fuels treatments (mechanical and prescribed fire), forest health, and establishment and maintenance of shaded fuel break systems. The land use plans also emphasize swift and efficient initial attack on wildland fires. Whiskeytown fire personnel provided input during the planning process of each document.

Regulations and Policy

The federal wildland management policy of 1995 stresses the importance of developing and maintaining local interagency coordination and cooperation. The national fire plan of 2000 re-emphasizes local coordination and cooperation in preparedness and fuels management in order to reduce the fire risk to western rural communities.

Issues and Impacts Common to All Alternatives

All alternatives would complement and enhance the land use plans of Whiskeytown's neighbors by providing additional area initial attack and suppression forces and reducing hazard fuels through the management strategies of prescribed fire and mechanical treatments.

Alternative I

Alternative I is compatible with BLM, CDF, and WSRCD plans. The shaded fuel break system currently being implemented by the park is a component of these plans. The emphasis on pre-fire treatments, such as fuels management, is consistent with all land use plans.

Alternative II

Alternative II has a conflict with adjacent land use plans because of the elimination of the shaded fuel break system. The West Redding shaded fuel break system, which has been developed by the local cooperating agencies, includes the lands in Whiskeytown- - they are strategic areas that are essential to the effectiveness of the program. The emphasis on reducing hazard fuels is compatible with adjacent land plans. Long- term impacts would be potentially beneficial, with improved forest health and reduced wildland fire risk, but increased risk from prescribed fire escape and increase smoke. Long- term suppression would be mixed- - reduced fuels but reduced access for firefighters (due to lack of shaded fuel break system) during holding actions.

Alternative III

Alternative III is generally compatible with adjacent land use plans. Its emphasis on preparedness, suppression, and hazard fuel reduction is especially compliments the CDF state plan, and area plans. The expanded use of mechanical treatment is compatible with land use plans. Its lack of emphasis on forest health is slightly at odds with the BLM plan. Long- term impacts would be good for suppression actions, with an expanded shaded fuel break system, but a fuels buildup in the interior portions of the Recreation Area would make suppression difficult, raising fire risk. Wildland fires could grow rapidly and test the shaded fuel break system, and adjacent areas burned. Mechanical treatment areas would be tested also.

Alternative IV

Alternative IV is generally compatible with adjacent land use plans. The increased emphasis on the shaded fuel break system, and mechanical treatments for fuels is emphasized in land use plans. The additional emphasis on mechanical treatments, including the use of mechanized equipment to reduce brush and thin trees, is compatible with adjacent land use plans, which currently call for mechanized equipment to reduce hazard fuels and restore landscapes.

A potential conflict is the added strategy of wildland fire use. This strategy is not utilized by CDF on their direct protection lands, and would be a new strategy for the area. The potential conflicts can be mitigated by careful application of this strategy, close cooperation between CDF and National Park Service, and a clear understanding of the parameters of the use of this strategy.

Conclusion

The proposed alternatives are generally compatible with adjacent land use plans. The emphasis on more effective suppression and more active fuels management is consistent would land use planning by fire agencies in the Shasta- Trinity county area. Alternative II has a potential for conflict because it does not provide for a shaded fuel break system, and increases the risk of prescribed fire escape. Alternative IV has a potential for conflict with the wildland fire use strategy. Alternative III does not provide for extensive fuels management of the interior of the park, and has a potential long- term conflict because of the lack of meaningful hazard fuel reduction in the interior, and forest health by restoring fire to the natural system. None of the alternatives would impair park resources.

Health and Safety

Impacts and Issues Common to All Alternatives

Due to the abundance of flammable landscapes, plentiful natural and human ignition sources, and hot, dry summers, no alternative eliminates the health risk of smoke for firefighters, visitors, or communities. Unwanted wildland fires would occur and produce smoke under all alternatives. Alternatives that allow more control over the timing, placement, and conditions under which fires burn would be more successful at minimizing smoke impacts over the long-term.

All individual wildland fire use and prescribed fire projects would be managed under the same conditions and constraints under all alternatives. Each project would be implemented only with the concurrence of the Shasta County Air Pollution Control District, and managed to maintain smoke emissions in communities below the legal thresholds as defined by the State of California and the Environmental Protection Agency. To accomplish this, smoke impacts would be managed and mitigated according to requirements contained in the *Fire Management Plan*.

While the park intends to manage all wildland fire use and prescribed fire projects so that established health limits are not exceeded, it is recognized that some individuals exposed to smoke may be sensitive or susceptible to smoke impacts at levels below the legal limits. Under all alternatives, the parks would manage this potential impact through a system of identification of sensitive individuals in the affected communities, advance notification to help affected parties mitigate or avoid potential impacts, and any other actions deemed reasonable and as directed by the Air District.

Firefighters are exposed to the highest health risk from smoke on or near the firelines. The risks are well-studied and include carbon monoxide, hydrocarbons, and particulates. Standard firefighting practices are employed to minimize firefighter exposure. These practices include: planning the location of firelines to minimize exposure, rotating firefighters out of smoky segments of the fire line at frequent intervals, and providing rest and sleep areas away from areas of significant smoke on long duration events.

Most byproducts of wildland fire combustion of health concern are concentrated at the fire line, and decrease to negligible levels in very short distances. Fine particulates however, may travel much greater distances from firelines. While they also become diluted with distance, their ability to be transported away from the fire line makes this byproduct the one of most concern in relation to public health.

Since the health effect of smoke may occur some distance from actual fire events, the park focuses most attention on the impacts of the alternatives on park visitors, employees, and local communities that experience indirect smoke impacts, especially concentrations of fine particulates.

Generally, the greater distance from the fire, the larger the volume of air available to dilute smoke below levels considered harmful to humans. Higher elevation fires typically loft smoke into mixing air masses, diluting the smoke further. Local weather patterns affect smoke mixing and movement, especially at night. Wildland fires similar to those in 1999, when numerous wildland fires were burning simultaneously throughout northern California could affect the park and, thus, the health and safety of visitors and park employees for several weeks.

Smoke impacts are not directly related to increasing wildland fire acreage. For example, grassland fires produce much less smoke per acre than do forest fuels. Even areas of similar vegetation types in forested areas may have significantly different amounts of emissions due to lower fuel load and smoke production in restored areas compared to areas that have missed several cycles of wildland fire and contain unnaturally heavy fuel loadings.

Methodology, regulations and policy

Fire management activities and the potential for injury, illness, and other direct and indirect impacts are evaluated for their potential to affect public and fire personnel during fire management activities at Whiskeytown National Recreation Area. The analysis includes the impacts of prescribed fire, suppression, wildland fire use and mechanical treatment on the health and safety of the public and fire personnel.

Impacts

Type

Direct – Impacts that result to public or fire line personnel from participation or exposure to fire management activities.

Indirect – Impacts that result to public or fire line personnel from exposure to smoke or particulates at a distance from the fire line.

Duration

Short-term – Would be temporary in nature, during the period when a fire management activity would take place.

Long-term – Would have a permanent or extended effect on the public or fire line personnel.

Intensity

Negligible – Imperceptible or undetectable effect upon public or fire personnel.

Minor – Minor impacts would be slightly detectable or localized, upon public or fire personnel within a portion of the body.

Moderate – Moderate impacts would be those that are readily apparent but that would not result in limits on activities.

Major – Major impacts would be substantial, highly noticeable impacts and/or impacts that would result in limits on activities.

The health and safety of firefighters and the public is the highest priority in every action undertaken as it relates to firefighting strategy and tactics. Director's Order #18 (DO 18) states "...firefighter and public safety must be the first priority in all fire management activities." *National Park Service Management Policies* states "all wildland fires would be effectively managed, considering resource values to be protected and firefighter and public safety..." All actions taken involving wildland fire have as their overriding goal providing for firefighter and public safety.

On an event level, mitigation measures are implemented to limit the public's direct exposure to fire. Mitigation includes temporary trail closures, trail cautionary signing, strict road visibility standards, and the temporary closures of facilities. These measures are included in the park's *Fire Management Plan*.

Issues and Impacts Specific to Each Alternative

Alternative I

Public Safety

There is no expected increase in fire- caused injuries to visitors, employees, and the public. Under Alternative I, fire operations would remain at current levels with intermittent visitor, employee, and general public exposure to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low lying areas or canyon bottoms. The

infrequent but likely occurrence of high intensity fires burning in accumulated fuels resulting from fire suppression would pose a high threat to the safety of both firefighters and the public.

Fire Personnel Safety

Since fire operations would remain at current levels, there would not be an immediate increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. Over time, as fuels continue to accumulate in untreated areas of the parks and the risk of high severity fire grows, fire personnel would be exposed to increasingly hazardous conditions. Efforts at direct attack or suppression of intense fires would also pose a threat to firefighter safety due to the nature of such activity. Hazards of the work include fire line construction, tree falling, helicopter transport, direct flame exposure, and respiratory problems due to smoke inhalation.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and firefighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative II

Public Safety

There is no expected increase in fire-caused injuries to visitors, employees, and the public. A significant increase in prescribed fire operations would occur which has the potential to increase the exposure of visitors, employees, and the public to ground level smoke particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low-lying areas or canyon bottoms. Public exposure to hazards, and risks of fire damages, should be progressively reduced over time.

Fire Personnel Safety

There would be a significant increase in the number and extent of prescribed fire operations which would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. An increase in injuries may occur but it is not possible to predict with any certainty the increased rate of injury. The planned nature of prescribed fire events should allow for a lower rate of injuries than Alternative III, given the unplanned nature of suppression events. The use of prescribed burns allows fire line construction, tree falling, and firing operations to be conducted in a more orderly and safer manner than during emergency fire suppression. Fires are generally of lower intensity. Hazardous exposures from extended patrol, moisture-laden smoke, and handling petroleum products are greater than Alternative I. Tactics to control prescribed burns are as in Alternative I with more exposure to employees to hazards.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and firefighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative III

Public Safety

The infrequent but likely occurrence of high intensity fires burning accumulated fuels resulting from fire suppression would pose an increased threat to the safety of both firefighters, employees, and the public. An increase in unplanned suppression fires has the potential to increase the exposure of

visitors, employees, and communities to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low-lying areas or canyon bottoms.

Fire Personnel Safety

An increase in the number and extent of suppression fires would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. This exposure would be unplanned with the potential for a higher rate of injury than Alternative II. Efforts at direct attack or suppression of intense fire would also pose a threat to firefighter safety due to the nature of such activities. Hazards of the work include fire line construction, tree falling, helicopter transport, direct flame exposure, and respiratory problems due to smoke inhalation.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and firefighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative IV

Public Safety

There is no expected increase in fire-caused injuries to visitors, employees, and the public. A significant increase in prescribed fire and limited wildland fire use operations would occur, which has the potential to increase the exposure of visitors, employees, and the general public to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend, and concentrate in low-lying areas or canyon bottoms. Hazards and risks to the public shall be reduced as in Alternative II. Hazards inherent to fire suppression shall be as described for Alternatives I and II.

Fire Personnel Safety

There would be a significant increase in the number and extent of prescribed fire, mechanical treatment, and limited wildland fire use operations which would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire, smoke, and personal injury. There would be increased employee exposure from more prescribed burn activity. Direct exposure to flame by employees to hazards in wildland fire use operations is lessened and there is the option to stay away from smoke. There are less tools, equipment, and materials-handling exposures. These benefits are offset by the larger, and sudden, employee exposures required by conversion of a natural fire that has exceeded its prescription to an emergency suppression action. Public safety is often a factor in such decisions. The magnitudes and complexities of such actions, although less frequent than numerous small fire suppression or prescribed burn actions, could result in higher exposures to hazards. Because of a subtle human tendency to regard “prescribed” burns, or natural fires, as less hazardous than other forest fires, there is employee susceptibility to perils by acceptance of exposure to lower perceived hazards.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and firefighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Conclusions

No alternative eliminates all health and safety concerns, though the alternatives vary in their ability to manage and mitigate impacts. All actions under all alternatives would be managed to fully comply with legal requirements for protection of public health and safety, including smoke impacts. Public and firefighter safety is the highest priority for all actions.

Alternative II provides optimum management control over the timing, and placement of fire events, and hence provides the greatest control over the amount of smoke produced and minimizes the number of riskier emergency responses. Using a combination of prescribed fire and unplanned ignitions, Alternative IV allows somewhat less management control over the timing, placement, and size of fire events than Alternative II, but is much better in this regard than Alternative III. Since Alternative III relies heavily on random ignition events, the opportunity for management control over the timing and placement of fires is minimal and results in an increasing probability of unwanted smoke events. Alternative I minimizes smoke impacts in the short-term, but does not significantly address the continued accumulation of fuels. Alternative I would be expected to produce more and larger unwanted smoke events as resistance to control and fuels increase with time.

Table 4-11 Alternative health and safety comparison.

	Alternative I	Alternative II	Alternative III	Alternative IV
Safety	●	○	○	●
Smoke	○	●	○	●

● – adequately addresses this issue

○ – inadequately addresses this issue

Community Economics

Impacts and issues common to all alternatives

The fire management program may have both direct and indirect impacts on the local economy. Direct impacts include the park's transactions with local businesses that supply goods and services for fire management activities. Additional direct impacts come from employees on the fire program payroll who procure personal housing, food, goods, and services from local businesses. Indirect impacts include the impact of fire management activities on tourism.

While there are some differences in payroll and support costs between the alternatives, it should be noted that the core program size and cost is primarily driven by the organization needed to effectively prevent and suppress unwanted fires. Those costs remain relatively constant across all alternatives. Most of the differences in cost across the alternatives reflect those necessary to both maintain an adequate suppression force as well as a proactive fuels management program. The costs for proactive fuels management programs are not completely additive to suppression costs since some resources are shared between the two functions. Economies of scale are also achieved when combining suppression and proactive management actions.

For all alternatives, the economic impacts of mechanical fuel reduction would be significant since the park is required to spend its Wildland Urban Interface (WUI) funds in the local communities.

Year 2000 visitor statistics for the park during the primary visitor season (May through September) totaled 750,000. This figure is used as a basis for comparing the magnitude of potential impacts on tourism across the alternatives.

Each of the alternatives has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways.

The analysis of program costs in this Section considers the full range of fire management activities, including the cost of infrequent large unwanted fire events such as the 1990 Kanaka fire, which eventually burned over 3,000 acres of parkland. The analysis in this section primarily evaluates the costs associated with the core fire program envisioned under each alternative, which as a matter of course includes preparedness and initial attack suppression capabilities.

Factors used to assess consequences

Fire Management Payroll

The size of the fire management program payroll varies by alternative. Since most of the money paid to fire staff is spent in the local communities in the form of housing, food, and services, increases in total payroll would be expected to have a net beneficial effect on local community economics. Similarly, alternatives with smaller payrolls would have a less beneficial effect.

Program Support

In addition to payroll inputs to the community through its employee base, the fire management program also inputs dollars directly into the economy to support program operations. Purchases are made directly from local businesses for goods and services including food, supplies, and other items.

For this analysis, the assumption is made that the same *proportion* of payroll and support dollars would be spent in the local communities from each alternative. Therefore differences in program budgets between the alternatives are used as a direct indicator of the effect of that alternative's potential economic impact on the local economy.

Tourism Impacts

Park visitation data from 1990 through 2000 shows the summer period (May through September) as typically the busiest tourist months. Those months coincide with the primary fire season. Since it is difficult to directly tie tourism spending to the fire management alternatives, this assessment addresses the relative expected impacts of alternatives on visitation. The level and extent of the effect on tourism due to fire operations is difficult to accurately quantify and convert directly into dollar figures. However, some assumptions may still be made regarding the relative impact of different fire management alternatives.

Direct impacts on tourism from fire operations may come from road or facility closures due to fire operations. Over the past decade such road closures have occurred approximately five (?) times for short periods of time on the primary thoroughfare through the park, Hwy. 299. All of the closures were a result of fire suppression operations resulting from the need to fight unwanted wildland fires. However, since these closures were to vehicles passing through the park, it is highly likely that there was negligible financial impact on businesses in communities adjacent to the park or the local community.

Offsetting potential tourism business lost in communities affected by closures is the financial impact of firefighting efforts that are usually associated with such closures. In all cases over the past 10 years where this has occurred, numerous commercial lodgings, restaurants, and other local business benefited providing for the needs of the firefighters involved in the suppression effort.

Indirect impacts on tourism may come from the impacts of smoke or loss of visibility in local communities, causing shortening or cancellation of visits. Over the past decade there have been several smoke events from both managed fires and wildland fire events that affected local communities. These included the 1997 Shasta Divide and 1998 Mill prescribed fires, the 1999 High Complex and Big Bar wildland fires, and the 1991 Kanaka wildland fire. How and to what extent these events affected a mobile tourist population is unknown. Assumptions may be made that more, or more severe, smoke events may result in a reduction in length- of- stay negatively impacting local business, though several of the events, such as the 1997 Shasta Divide prescribed fire, occurred during October outside the primary visitor season.

Recent experience suggests that indirect impacts of prescribed fire on recreational visits is slight, as most prescribed burns are conducted in the fall when visitation to the park is minimal, while the visual impacts of large high severity fire events may cause significant decreases in recreational use. Therefore, in this assessment, it is assumed that alternatives that decrease potential for high severity events would have a more beneficial effect on recreational visits.

Methodology

Under this topic, the alternatives are evaluated as to their socioeconomic impacts on local communities. Socioeconomic impacts include direct potential direct impacts of property loss, and potential indirect impacts in economic terms, in the event of park closures.

Type

Adverse – would degrade or otherwise negatively alter the characteristics of the existing environment, as it relates to local communities, visitor population, regional economies, and concessionaires and contractors.

Beneficial – would improve upon characteristics of the existing social and economic environment, as it relates to local communities, visitor population, regional economies, and concessionaires and contractors.

Duration

Short- term – temporary in duration and typically transitional impacts associated with implementation of an action.

Long- term – permanent impacts on the social and economic environments.

Intensity

Negligible – Not detectable and expected to have no discernible effect on the social and economic environment.

Minor – Slightly detectable and not expected to have an overall effect on the character of the social and economic environment.

Moderate – Detectable, without question, and could have the potential to initiate an increasing influence on the social and economic environment (particularly if other factors have a contributing effect).

Major – Substantial, highly noticeable influence on the social and economic environments, and could be expected to alter those environments permanently.

Impacts and issues specific to each alternative

Alternative I

Alternative I, as well as the other alternatives considered, has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. Alternative I proposes localized strategies to reduce hazardous fuel conditions in the park.

The greatest potential for high severity fires would be in Fire Management Unit (FMU)1 and along the margins of FMU 1, the suppression area of the park. All of the park developed areas as well as the Shasta Divide area on the eastern boundary are all within or along FMU 1, and forest conditions around each of these communities are among the most changed in the park, due largely to past and successful fire suppression activities. Forest conditions have changed in and around Wildland Urban Interface areas. In this alternative, high severity fire would continue to have the potential to effect these communities through both direct impact, (i.e., property loss and damage as a result of fire in the Wildland Urban Interface), and indirect impacts of closures and other actions, (i.e., loss of business and its economic impacts).

Under this alternative, the potential for large, high intensity high severity wildland fires would remain high in and around Oak Bottom, Brandy Creek, Whiskey Creek, Park Headquarters and the adjacent community of Old Shasta. There would be approximately 100 acres of fuels treated mechanically per year, and 1,400 acres of prescribed burning. At this level of accomplishment, it would not be possible to accomplish restoration objectives, meaning the risk of large, high intensity, high severity fire would remain high. In the event of high severity fire in these communities, the impact would be great. This impact would be adverse, long- term and major. Similar impacts would be expected in any of the other communities bordering the park in the event of large, extreme fire behavior fires. Potential direct impacts from high severity fire in Wildland Urban Interface would include adverse, long- term and major impacts.

Potential indirect impacts would include loss of revenue in both local and regional communities. Because of closures associated with high severity wildland fires. This would include loss of business activity in the Redding area (i.e., loss of business at lodging, restaurants, gift shops and various services). Because of the potential for high severity fire in FMU 1, the likelihood of having fire- related closures during the life of the plan would be high. Major impacts would likely include short- term job loss (or reductions in hours worked), and reductions in personal income, with the significance of this effect (by person) highly variable, but overall a closure of this duration would have adverse, short- term and moderate impacts.

Costs of this Alternative would continue to increase as the shaded fuel break system is expanded and WUI- funded projects continue to inject money into the local economy. Some of this money would be used to reduce risks in WUI areas, but much of the work would be to accomplish restoration objectives. With the amount of WUI burning that would be done annually, risk reduction objectives would not be accomplished during the life of the plan. Furthermore, because mechanical thinning would not be a part of this alternative (100 acres or less of thinning,

mostly by hand, would occur), it is doubtful that prescribed fire would effectively reduce risks in some areas. This is because prescribed fire in some of the densest areas (where logging historically occurred), when applied under controlled conditions and not in combination with mechanical treatments, would be unlikely to be effective at restoring forest community structure around WUI areas in Whiskeytown today. The likelihood of being effective at suppressing all fires in WUI areas would decrease further over time as forest conditions continue to change. Considering the potential for high severity fire in WUI areas, the impacts of prescribed fire would be locally beneficial, but overall, the risk would remain high. The impacts of prescribed fire would be beneficial, long- term and minor to moderate.

Prescribed fire use in WUI areas would impact residents through smoke and site closures. During prescribed fire activities, residents and visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but smoke would effect all down- wind locations in the area. Some residents would have concerns about the smoke, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. Overall, these impacts upon local communities would be adverse, short- term and minor.

There are risks and uncertainty associated with implementing a successful fire management strategy that includes prescribed fire. One intent of the program is to do enough fuels treatment in enough places to influence wildland fire in the intended ways. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires.

This alternative utilizes mechanical treatment level 1 only, so there would be no biomass removal operations. Hand thinning and chipping would result in approximately 100 acres of thinning in Wildland Urban Interface areas. Though locally effective, the small number of acres treated would limit the overall effectiveness of the alternative in reducing the risk of high severity fire. It would not be possible to bring Wildland Urban Interface areas back to within target conditions during the life of the plan, except on a limited, local basis. Large- fire potential would continue to increase. Impacts would be beneficial, long- term and minor.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative I would remain adverse, short- term and moderate.

Fire management- related projects would include the continued expansion of the shaded fuel break system, utility right- of- way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the national park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long- term, beneficial and moderate to major impacts of these actions, the minor impacts of the treatments in Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short- term and moderate.

Payroll costs for employees in the parks' fire management program under this alternative would be approximately \$800 thousand annually. Total additional dollars for program support and proactive fuels management would be \$720 thousand annually.

Offsetting the local economic benefits from fire payroll and support spending are expected periodic adverse impacts for the tourism industry as fire projects are implemented and fire

suppression occurs resulting in road or facility closure. Impacts resulting from unplanned fires requiring suppression are expected to increase as suppression acres increase.

Under Alternative I, there are no irreversible and irretrievable commitments to resources.

Cumulative Impacts

There are not a lot of fire management projects in the Shasta County area that would significantly impact the local community. Although the population of Shasta County continues to increase, there are not a lot of lodging and service projects or utility and infrastructure projects that could have an effect upon visitation within the local community. There are a few projects of the type described in the proposed action, e.g., projects dealing with fire, fuels, and vegetation management matters.

While there may be some projects that would potentially bring about increases in visitation and spending growth, closures during periods of high severity fire would bring about short- term decreases in both visitation and spending. Considered in combination with the long- term, minor and beneficial economic impacts of new development in the community, the impacts of infrequent closures under Alternative I would remain adverse, short- term and moderate.

There are very few fire management- related projects occurring on lands adjacent to the park. Thus, any actions taken on these lands would result in impacts similar to fire management activities in the national park, with the same types of risks. Actions taken to reduce the risk of high severity fire would potentially restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long- term, beneficial and minor impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short- term and moderate.

Alternative II

Alternative II, as well as the other alternatives considered, has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. Alternative II proposes landscape strategies to reduce hazardous fuel conditions in the park.

Because of the aggressive nature of carrying out prescribed fire and Wildland Urban Interface programs in this alternative, the risk of high severity fires that would spread into Wildland Urban Interface areas would be much lower than under the No Action alternative. The greatest potential for high severity fires would be in Fire Management Unit (FMU)1 and along the margins of FMU 1, the suppression area of the park. Risk near Oak Bottom, Brandy Creek, Whiskey Creek, and adjacent local communities would be greatly reduced by actions intended to bring plant communities along and within Wildland Urban Interface areas back to within restoration target conditions. In this alternative, high severity fire would continue to be a risk, but fire in treated areas would typically have acceptable fire behavior, making it easier to protect WUI areas. Potential impacts during high severity events would be less in terms of both direct impacts, i.e., property loss and damage as a result of fire in the Wildland Urban Interface, and the indirect impacts of closures and other actions, i.e., loss of business and its economic effect.

Under this alternative, the risk of high severity fire would remain, but fire behavior would be less severe, because of the amount of prescribed fire and Wildland Urban Interface treatment that would occur on an annual basis. There would be up to 3,000 acres treated per year with prescribed fire and another 600 acres of WUI treatment. At this level of accomplishment, it would be possible to accomplish restoration objectives and to reduce the risks of large, high intensity, high severity fire, meaning the size and effect of these fires when they occur. Fuel hazard reduction around developments would reduce the potential of direct economic loss within the planning area. Any direct impacts in Wildland Urban Interface that would occur because of high severity fire would still likely be adverse, long- term and major, but the potential of these impacts occurring would be greatly reduced under this alternative.

The potential for large, high severity fires would not be gone under this alternative, but the potential for indirect impacts, in the form of revenue loss due to park closures, would be lower. It would be difficult to estimate the duration of any possible closures under this alternative, but closures would be fewer and, when they occurred, shorter, because fire behavior in treatment areas would generally be more acceptable and manageable. Economic impacts on a per visitor basis would most likely be the same as in Alternative I, but closures would likely be of shorter term, as fires would reach treatment areas. A fire like the Kanaka, had it encountered scattered fuel treatment areas, would possibly have been less difficult to manage, and it would have been possible to do so in a shorter period of time. Thus, the potential economic impacts of a closure would have been adverse, short- term and minor, less than under a scenario similar to the Kanaka fire under Alternative I, No Action.

It should be noted that total park closures have been very rare in the history of Whiskeytown. Also, actual fire conditions (i.e., when and where a fire would occur) would dictate the values at risk, the measures needed to assure public safety, the extent of closure needed to assure public safety, and thus any resulting economic impacts. The indirect threats for economic losses from fires within the planning area could be increased by prescribed burning in hazard fuel accumulations near boundaries of the planning area. The element of risk is primarily the chance of escape of a fire from the planning area on to economic use lands, or loss of structures. However, the precautions in place in conducting this program would minimize this risk. Actual fire events are very difficult to foresee, but closures under this alternative would likely have adverse, short- term and minor impacts, compared to No Action.

Expected adverse impacts for the tourism industry would be greater initially than for Alternative I, but decrease over time as fuels treatment leads to a reduction in fuels across the park. Adverse impacts could be partially mitigated through proper planning for prescribed fire events, reducing their randomness and subsequent impact upon the community.

Prescribed fire would be the primary tool used to reduce risks associated with fire in and near Wildland Urban Interface (Oak Bottom, Brandy Creek, Whiskey Creek, Park Headquarters, and others). Under this alternative, up to 3,000 acres would be burned per year, and much of this would be in combination with an average of 600 acres of Wildland Urban Interface work (thinning and fuel reduction) per year. This work would be done to accomplish objectives for restoring plant community structure and reducing risks around WUI areas. With the amount of WUI treatment that would be done annually, it is likely that risks would be greatly reduced during the life of the plan. The potential for high severity fire in WUI areas would be greatly reduced as a result. Prescribed fire under this alternative would have beneficial, long- term and major impacts.

Prescribed fire use in WUI areas would impact residents through smoke and site closures. During prescribed fire activities, residents and visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but smoke would effect all 'down- wind'

and 'in- basin' locations in the area. Some residents would have concerns about the smoke, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. Overall, these impacts upon local communities would be adverse, short- term and minor.

There is risk and uncertainty associated with implementing a successful fire management strategy that includes prescribed fire. One of the goals of the program is to do enough fuels treatment in enough places to influence wildland fire in the intended ways. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires.

Less than 100 acres of thinning would occur in Wildland Urban Interface areas to reduce risks. However, because of the increase in the amount of biomass removal through mechanical means under this alternative, overall risk in communities would be less. As a result, hand thinning would contribute to an overall reduction in risk, but its contribution would be similar to that of Alternative I - No Action, beneficial, long- term and minor.

Alternative II would utilize Mechanical Treatment Level 2 to remove biomass in designated prescribed fire units and on shaded fuel breaks, where appropriate. This would be used in combination with hand thinning and chipping, as in Alternative I. There is a major increase in fuels reduction work compared to no action, and would greatly reduce risks of high severity fire and loss of property in the developed areas in the park and communities adjacent to the park. The effect would be beneficial, long- term and moderate to major.

Equipment use would occur along and within WUI areas. During periods when equipment is in use, visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but noise levels could be a concern to some. Some visitors would have concerns about equipment use in the national park, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. These impacts upon local communities would be adverse, short- term and minor.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative II would remain adverse, short- term and moderate.

Fire management- related projects would include the continued expansion of the shaded fuel break system, utility right- of- way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the national park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long- term, beneficial and moderate impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative II would potentially become beneficial, short- term and moderate.

Payroll size would increase through the addition of additional operations crews and resources. Payroll would increase to approximately \$900 thousand annually. Total additional dollars for program support and proactive fuels management would increase to about \$800 thousand annually. The park fire management organization would be required to expand.

Because the risks associated with large, high severity fires would be greatly reduced in this alternative, direct impacts (loss of property during fires) and indirect impacts (loss of business during fire- related closures) would be greatly reduced compared to No Action. This is because prescribed fire and mechanical thinning would restore plant community conditions in WUI areas to within the range of target conditions, reducing the risk of high severity loss. The potential for fire- related closures and other impacts would also be lower. As a result, the overall affect of this alternative on local communities would be beneficial, long- term and moderate to major.

Under Alternative II, there are no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative II are the same as those discussed in Alternative I.

Alternative III

Costs of this traditional strategy are being increasingly borne by higher public expenditures. In the short- term, suppression is the most economic fire management alternative. There would be a reduction of economic loss from suppression of potentially damaging fires. However, this program would be costly. Over the long- term, however, the costs of this program steadily increase in a relationship with fuel accumulation, and its corollary: resistance to fire control. The increase in potential for high severity fires could cause economic disruption from loss of exploitable natural resources outside the park boundary and deterioration of visitor experience within the park. There are local economic impacts from employment of fire suppression personnel and support services. The increasing potential of high severity fire poses direct and indirect threats to capital improvements, economically significant natural resources, and human safety due to the difficulty of the suppression effort.

This alternative would have the least amount of Prescribed Fire, per year, among the action alternatives, although this alternative would also have the most shaded fuel break acres treated. The treatment acreage would be significantly less than under No Action, resulting in adverse impacts upon and risk levels for local communities that would be greater than under Alternative I, No Action. But the level of risk from the impacts of high severity fire would remain high and would be the greatest among the action alternatives. The amount of annual accomplishment for WUI work would meet objectives for protecting these areas within approximately 10 years, but the ecosystem restoration work would probably never be achieved, meaning the potential for large, high intensity high severity fire would remain high for much of the implementation period. Even with the WUI work completed, large fires could potentially run through the area and put WUI areas at risk, despite efforts to hold the fires and protect communities.

The impacts of high severity fire would be similar to Alternative I, except that risks for local communities would be abated by the schedule for WUI treatment, which would put protective areas around the communities within ten years.

A slightly higher level of adverse impacts on tourism would be expected due to the random nature of the ignitions. Unplanned ignitions managed for suppression during the fire season without prior restoration of natural fuel loads could lead to more smoke production during the tourist season. Mitigation strategies would be more limited than with prescribed fire treatment (Alternative II) or combined strategies (Alternatives I and IV).

Prescribed fire operations typically occur within a defined project area. Approximately 250 acres would be treated in an average year, compared to 1,400 acres pre year under No Action, increasing the risks associated with high severity fire, compared to No Action. Even with this amount of annual work, however, it would still be very unlikely that the park could accomplish

ecosystem restoration objectives, meaning that the risks associated with high severity fire would remain high through much of this period. Impacts of prescribed burning on local communities would be beneficial and long- term, but moderate.

This alternative utilizes Level 2 mechanical treatment to reduce biomass and fuel loading. There would be approximately 450 acres of mechanical treatment work and 1100 acres of shaded fuel break work completed in WUI areas per year. This would accomplish WUI objectives for protection of park resources and local communities in approximately 10 years, reducing risks near communities compared to No Action. Although high severity fire potential would remain great, the opportunity to protect these communities would be improved compared to No Action. The impacts of biomass removal would be beneficial, long- term and moderate to major.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative III, would remain adverse, short- term and moderate.

Fire management- related projects would include the continued expansion of the shaded fuel break system, utility right- of- way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the national park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long- term, beneficial and moderate impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative III would potentially become beneficial, short- term and moderate.

Under Alternative III, there are no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative III are the same as those discussed in Alternative I.

The park fire management organization would remain at about the same staffing level. Total payroll and total support dollars available would be the same as Alternative II.

Alternative IV

This alternative would have an intermediate amount of Prescribed Fire and WUI Treatment per year and would also include wildland fire use. The treatment acreage would be greater than under No Action, reducing the impacts upon and risk levels for local communities. The amount of acres treated annually would meet objectives for protecting WUI areas within 6 to 8 years, greatly improving the opportunity to protect communities in and near the park from fire.

Initially, the impacts of this alternative would resemble Alternative II. There would be the expenses associated with programs and fire suppression operations. The park fire management operations would expand. Theoretically, at some future time (an undefined condition of reduced risks of wildland fire escape from lighter fuel loads and broken continuities of natural fuels), costs of such programs would decrease. Potential for economic losses resulting from damages to economic values would be reduced, as would disruptions to visitor uses.

The impacts of high severity fire would be similar to those under Alternative II. There would be approximately 2,200 acres treated with prescribed fire in an average year, compared to 1,400 acres per year under No Action, reducing the risks of high severity fire compared to No Action.

Impacts of prescribed burning on local communities would be beneficial and long- term, and major.

Alternative IV is the only alternative to include Mechanical Treatment Level 3. There would be approximately 640 acres per year of mechanical treatment work completed in WUI areas and 955 acres per year of shaded fuel break work. This would accomplish WUI objectives for protection and ecosystem restoration in 6 to 8 years, reducing risks near communities compared to No Action. Although potential for large fires would remain, the opportunity to protect these communities would be improved compared to No Action. The impacts of biomass removal would be beneficial, long- term and major.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Anticipated adverse impacts on tourism would parallel the No Action alternative. There would be a potential for an initial increase in impacts as treatment activity increased, but long- term impacts from individual events would be reduced over time as fuels were restored to more natural levels. Thus, as in No Action, the impacts of infrequent closures under Alternative IV would remain adverse, short- term and moderate.

Fire management- related projects would include the continued expansion of the shaded fuel break system, utility right- of- way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long- term, beneficial and moderate impacts of these actions, the moderate to major impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short- term and moderate to major.

Payroll size would increase by roughly one- fifth with the addition of operations crews and support staff. Total payroll would increase to approximately \$1 million annually while. Total additional dollars for program support and proactive fuels management would be approximately \$1.2 million annually. The budget for this program would be the highest of all alternatives, resulting in more economic benefit to local economies from that source.

Under Alternative IV, there are no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative IV are the same as those discussed in Alternative I.

Cost

Annual program costs and costs per acre vary by alternative. To respond to emergencies and unwanted fires, under all alternatives, a core suppression program is assumed. That core suppression capability remains constant across the alternatives, with changes in strategies and accomplishments to achieve additional resource management and ecosystem objectives accounting for most of the variation in overall costs between alternatives. These figures contain estimates that take into account the funds needed to control and suppress infrequent, but expensive, large wildland fires events. Such unwanted events are expected to occur several times each decade under all alternatives. Research conducted by Colorado State University show those alternatives that restore more park acres over time, and those that use fire more deliberately and less randomly, eventually result in a reduction in the rate of fires requiring aggressive suppression and a consequent increase in overall economic return (Omi et al, 1999).

In order to estimate the cost of each alternative, average operational cost estimates for each strategy were derived from budgets based on the existing fire management program in the park. The following tables examine the costs for each alternative by treatment strategy. They are based on current and projected payroll costs as well as the cost for conducting fire operations as described in the fire management plan.

The table below depicts the anticipated relative effect of different alternatives on local business based on program expenditures, including the relative effect of each alternative on tourism.

Program cost by alternative

Table 4-12 Economic benefit to local communities would be proportional to program expenditures

	Alternative I	Alternative II	Alternative III	Alternative IV
Direct Payroll	\$800,000	\$900,000	\$900,000	\$1,000,000
Support Costs	\$120,000	\$135,000	\$135,000	\$180,000
Contracts	\$600,000	\$800,000	\$900,000	\$1,200,000
Total Program Expenditures	\$1,520,000	\$1,835,000	\$1,935,000	\$2,380,000

In a comparison of the relative impacts of the four alternatives on tourism, both Alternatives I and III would have a moderately adverse impact. Alternatives II and IV, on the other hand, would have a slightly adverse to negligible beneficial impact.

Based on data from 1995- 2001, the average costs per acre for each strategy are as follows:

Table 4-13 Average cost per acre by treatment for each alternative

Strategy	Cost per acre	% of Fires -- 1990's	% of Acres -- 1990's
Mechanical Treatment *	Level 1: \$1,600/acre Level 2: \$1,000/acre Level 3: \$800-1,000/acre	N/A	N/A
Small Fire Suppression**	\$6,000/acre for fires < 10 acres	96%	2%
Large Fire Suppression **	\$6,000/acre for fires ≥ 10 acres	4%	98%
Prescribed Fire	\$225/acre	N/A	N/A
Wildland fire use – All Projects***	\$2,600/acre for all fires	N/A	N/A

* These figures represent the costs for typical mechanical treatment projects that have been undertaken in the park as well as estimates developed for proposed projects for Levels 2 and 3. Mechanical treatment costs per acre are driven primarily by high labor costs for contracted work.

** Most of the parks' suppression fires are small (96% are less than 10 acres), but the few large fires account for 98% of the acres burned. The cost per acre differs between small and large fires, with the cost per acre dropping on larger fires as a result of economies of scale. Suppression fire costs are driven by high labor and equipment costs. Suppression fires generally entail additional premium (hazard) pay and overtime for firefighters due to their hazardous working conditions and random occurrence.

*** The costs for wildland use fires are derived from the costs expended by two large parks (Yosemite and Sequoia National Parks) over a ten year span from 1990-1999. Although most wildland fire use fires in large parks are small (89% are less than 10 acres), the costs per acre vary with the size of the fire. The cost per acre goes down when the fire is larger as a result of economies of scale and the more effective use of natural boundaries for containment. Because only 150 acres per year are anticipated in this planning cycle, most fires in Whiskeytown would probably be smaller ones and the per-acre costs would remain high. Overall costs per acre are generally higher than prescribed fire due to remote locations and increased need for helicopter flights to monitor and manage the project.

The per- acre figures in the tables above were multiplied by the estimated acreage for each strategy under each alternative (see explanation in Chapter 2) and rounded to the nearest hundred dollars.

Fixed program costs necessary to maintain core suppression capabilities and manage the program were then added to come up with a total program cost estimate for each alternative. Fixed

program costs from the year 2001 were used for the first three alternatives. For Alternative IV, an estimated budget for the proposed program was derived from estimates by the national fire office, approximating the most efficient staffing level.

Table 4-14 Program summary of average acres/year to be treated by alternative

Treatment Method	Alternative I	Alternative II	Alternative III	Alternative IV
Mechanical				
Level 1	275	80	225	320
Level 2	N/A	N/A	225	310
Level 3	N/A	N/A	N/A	445
Suppression	142	142	142	142
Prescribed Fire	1400	3,000	250	2,200
Wildland Fire Use	N/A	N/A	N/A	150
Total	1,817	3,222	842	3,132

Table 4-15 Summary of average annual program costs by alternative

Program costs/year	Alternative I	Alternative II	Alternative III	Alternative IV
Mechanical				
Level 1 @ \$1600/ac	\$440,000	\$128,000	\$360,000	\$512,000
Level 2 @ \$1000/ac	N/A	N/A	\$360,000	\$496,000
Level 3 @ \$1000/ac	N/A	N/A	N/A	\$445,000
Suppression @ \$6000/ac	\$852,000	\$852,000	\$852,000	\$852,000
Prescribed Fire @ \$225/ac	\$315,000	\$675,000	\$56,250	\$495,000
Wildland Fire Use – All fires 150 acres @ \$2600/ac	N/A	N/A	N/A	\$390,000
Fixed program costs	\$920,000	\$1,035,000	\$1,035,000	\$1,180,000
Total	\$2,527,000	\$2,690,000	\$2,663,250	\$4,370,000
Average \$/acre	\$1,390	\$835	\$3,163	\$1,395

Conclusion

Alternative I demonstrates the lowest overall program cost while Alternative II shows the lowest cost per acre of all alternatives. Alternative I fails to achieve significant natural resource objectives while Alternative II, through optimizing the use of prescribed fire, provides a cost-effective alternative while achieving most objectives, having the second lowest overall program cost. Alternative III has the highest cost per acre with less certain outcomes for achieving program objectives due to the lack of proactive fuels management. Alternative IV has the highest overall program cost and third lowest cost per acre and fully achieves all program objectives.

The potential for high severity fire remains high in all of the alternatives for the life of this plan, as many areas of the park are being treated for the first time. The risk for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire- related closures) is high in Alternatives I, II, and III, although it would probably be highest in Alternative I. The risk in Alternative III for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire- related closures) would be reduced compared to No Action, but would remain the highest among the action alternatives. This is because of a lesser amount of annual prescribed fire and mechanical thinning accomplishment to restore plant communities in WUI areas and elsewhere in Fire Management Unit 1. The potential for fire- related closures and other impacts would also be only slightly lower than under No Action. Overall, the effect of Alternatives I, II, and III on local communities would be beneficial, long- term and moderate.

The risks associated with large, high severity fires would be reduced in Alternative IV, compared to No Action. The risk in Alternative IV for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire- related closures) would be greatly reduced compared to No Action, and would be intermediate among the action alternatives. This is because of the amount of annual prescribed fire and mechanical thinning accomplishment. The potential for fire- related closures and other impacts would also be lower than under No Action. As a result, the overall effect of this alternative on local communities would be beneficial, long-term and moderate to major.

It is unlikely that the combination of prescribed burning, shaded fuel break construction, and mechanical treatment would reduce the risk of unwanted fire to significantly decrease the potential economic loss to the community. As a result, the overall effect is beneficial, long- term and minor. There would be no impairment under this issue.

Recreation

Impacts and Issues Common to all Alternatives

All alternatives require some level of fire management operations which generally include fire detection, suppression, monitoring, igniting, and holding. Depending on location and time of year, these operations may cause temporary impacts to individual recreational experiences. Impacts include; noise from aircraft and other power equipment such as chainsaws and portable pumps, and temporary closures of roads, trails, or facilities to protect visitors from direct exposure to fire events. Smoke from fires may restrict visibility and impact view sheds, or become heavy enough to become a nuisance. The health impacts to visitors from smoke are addressed in Chapter 4, Health and Safety. However, given the relatively short duration of the average visit and the ability to be both mobile and flexible enough in itinerary to avoid smoke, exposure during the typical visit is minimal.

Under all alternatives, large, high- intensity high severity fires are likely to occur throughout the park until the majority of the park is restored to its natural function. Because fires have been, and would continue to be, suppressed, fuels build up and the plant community structure changes. It is unlikely that this situation would change during the life of this revised Fire Management Plan. If there were to be a large, high severity fire, visitors may be excluded from the park until the fire were controlled, impacting visitors during this period of time. Although it is possible that closures could be implemented on a limited- area basis, many would most likely be park- wide in nature, and affect all visitors as a consequence. During these closure periods, the impacts would be adverse, short- term and major, affecting all visitors. These events would likely occur during peak visitation periods, and over a limited timeframe.

Fire, when functioning to restore or maintain natural processes and conditions, helps to shape and renew the vegetation and wildlife habitats that are integral parts of many recreational pursuits in the park. Fire events may also create unique opportunities for visitor experiences and educational opportunities. The impacts of some fires, such as facilitating the germination of various tree species, and stimulating wildflower displays, may provide beneficial experiences.

The placement of the fire cache in Oak Bottom and the construction of a new park administration building in the current park headquarters compound would have similar impacts on recreation and park visitor experiences. In both cases there would be some moderately adverse, though short term, impacts caused by the construction noise and construction site management.

Mitigation of these impacts could be accommodated through the timing of construction so that it does not interfere with heavy visitor seasons. In the long term, however, both facilities would have a major beneficial impacts from significantly improved ability of the National Park Service to provide services to visitors. Oak Bottom campers and day use visitors would be easily reached by the public outreach and fire education programs. Park headquarters visitors would be more easily accommodated—meeting space within a new facility would mean a more central public meeting site; additionally, employees dispersed through the compound would be centralized in one location.

Methodology, regulations and policy

Fire management activities and the potential for closures, restrictions, and direct impacts are evaluated for their potential to affect visitation and an aggregate of recreational activities in Whiskeytown National Recreation Area. The analysis includes the impacts of prescribed fire, suppression, wildland fire use, and mechanical treatment on recreational experiences.

Impacts

Type of Impact

Adverse – Impacts that reduce visitor participation, quality of visitor experience, and/or service level.

Beneficial – Impacts that enhance visitor participation, quality of visitor experience and/or service level.

Duration

Short-term – Would be temporary in nature, during the period when a fire management activity would take place.

Long-term – Would have a permanent affect on the visitor experience.

Intensity

Negligible – Imperceptible or undetectable affect upon visitor experiences.

Minor – Minor impacts would be slightly detectable or localized, upon visitor experiences within a relatively small area.

Moderate – Moderate impacts would be those that are readily apparent but that would not result in limits on activities.

Major – Major impacts would be substantial, highly noticeable impacts and/or impacts that would result in limits on activities.

The enabling legislation for Whiskeytown states that the park is to “*provide...for the public outdoor use and enjoyment...by present and future generations, and for the conservation of scenic, scientific, historic, and other values contributing to public enjoyment of such lands and water.*” The National Park Service Organic Act of 1916, which outlines the fundamental purpose of the National Park System, directs the National Park Service to allow for public use and enjoyment of national parks, provided that the resources therein remain unimpaired for future generations.

Alternative I

The impacts from fire management activities under this alternative would be similar to those described in “common to all,” as there are no new programs or activities expected to alter visitors recreational experiences. The shaded fuel breaks that are currently being installed are on ridge tops far from areas of normal recreational use.

Prescribed fires would continue to be scheduled and managed in ways that limit their impacts upon visitors. The amount of prescribed fire activity in the No Action alternative would be

second least among the alternatives (approximately 1400 acres treated per year). Impacts upon recreational activities, including hiking, biking, and touring, would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire project boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures and restrictions. However, because prescribed fires would be ignited only under certain atmospheric conditions, the greatest smoke impacts would generally be localized. Impacts would be adverse, short- term, and minor.

Mechanical treatment activities that are currently being employed would continue under this Alternative. Most hand- thinning activities involving the use of chain saws would have negligible to minor, short- term and adverse impacts upon recreation. Piles of fuels would have the potential to affect scenic quality, but generally piles would be located to limit visibility and other impacts. Pile burning would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures, but because the piles would be burned under atmospheric conditions specified by the county, the smoke impacts would generally be localized. Impacts would be adverse, short- term and minor.

Chipping would affect visitors through small, localized, safety closures that would not limit visitors in their activities. Noise from the chipper would be the greater affect upon visitors. Some would move to another location to avoid the noise. Impacts would be adverse, short- term and moderate to major.

Under Alternative I, there would be no irreversible and irretrievable commitments to resources.

Cumulative Impacts

There have been very few actions taken inside or outside the park in the past to affect recreational opportunities. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long- term and minor.

Alternative II

In the short- term, this alternative may result in slightly increased adverse impacts to recreational use compared to Alternative I due to more aggressive implementation of a prescribed fire program. Impacts would take the form of occasional closures of roads or backcountry areas to implement fire operations. This alternative would have fewer adverse impacts on recreational use than Alternative III due to the fact that only Level 1 mechanical treatment would be employed to reduce fuel loadings and less than Alternative IV due to more rigid control over timing and placement of ignitions. Over the long- term, random and aggressive suppression actions would be reduced as more of the park was restored to natural fuel loads and forest density, reducing the duration and number of closures and smoke events.

Under Alternative II, prescribed fires would continue to be scheduled and managed in ways that limit their impacts upon visitors. The amount of prescribed fire activity in this alternative would be the greatest among the alternatives (approximately 3000 acres treated per year), more than twice the amount under the No Action alternative. Impacts upon recreational activities, including

hiking, biking, and scenic touring, would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire project boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. With the number of acres being treated annually, the potential for these impacts would increase compared to No Action.

The increase in prescribed burning would result in additional short- term impacts from smoke generated by more burning. Smoke would still affect more visitors than closures and restrictions. However, because prescribed fires would be ignited only under certain atmospheric conditions, the greatest smoke impacts would generally be localized. Impacts would be adverse, short- term, and minor.

The impacts from chain saw use and chipping would decrease under this alternative as a result of narrower firelines and shaded fuel break s. Firelines would be installed exclusively as prescribed burn unit boundaries, so they would be narrower and require less mechanical work to be installed.

Level 1 mechanical treatment activities would be implemented under this alternative, as in the No Action alternative. Most hand- thinning activities involving the use of chain saws would have negligible to minor, short- term and adverse impacts upon recreation. Chipping would affect visitors through small, localized, safety closures that would not limit visitors in their activities. Noise from the chipper would be the greater affect upon visitors. Some would move to another location to avoid the noise. Impacts would be adverse, short- term and moderate to major.

Piles of fuels would have the potential to affect scenic quality, but generally piles would be located to limit visibility and other impacts. Although more acres would be treated in this alternative than in No Action, hand- thinning activities would still have only negligible to minor, short- term and adverse impacts on recreation, as in No Action.

Pile burning would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures, but because the piles would be burned under atmospheric conditions specified by the county, the smoke impacts would generally be localized. Impacts would be adverse, short- term and minor.

Under Alternative II, there would be no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative II are the same as those discussed in Alternative I.

Alternative III

This alternative would have the least amount of prescribed fire and be in the mid- range in terms of mechanical treatment acreage treated among the action alternatives. The impacts upon recreation would be similar to that of Alternative IV in that the shaded fuel break system would be greatly expanded under both alternatives. This alternative is similar to Alternative IV in that both mechanical treatment levels 1 and 2 would be employed to remove biomass and reduce fuel loadings.

Prescribed fires would be used only to ensure firefighter safety by installing new shaded fuel breaks in the park utilizing pile burning and small prescribed burns, resulting in the least impact to visitors to Whiskeytown.

Mechanical treatment impacts would be the same as Alternatives I and II except for the use of brush clearing machinery, which would affect visitors through localized safety closures and equipment noise. Visitors would, however, be able to partake in their activity, including hiking, nature study and scenic touring, in another, nearby location, with limited or no restrictions. Some visitors would have concerns about equipment use in the national park, while others would understand the rationale for its use and would be supportive. Overall, the impacts upon recreation would be adverse, short- term and minor.

Under Alternative III, there would be no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative III are the same as those discussed in Alternative I

Alternative IV

This alternative would be slightly higher than mid- range in terms of the amount of prescribed fire and would result in the greatest amount of mechanical treatment among the action alternatives. The treatment acreages for both would be greater than under No Action. The impacts of prescribed fires upon recreation would be the same as Alternatives I and II. This alternative would result in the most adverse impacts to recreational use of all the alternatives due to the inclusion of wildland fire use and the removal of whole trees by mechanical means. More closures could be necessary due to the random nature of natural ignitions. This would be offset by the increase in proactive fuels management to reduce fuel loadings through mechanical and prescribed fire treatments.

The implementation of a wildland fire use program would affect recreation in Fire Management Unit (FMU) 2 (backcountry) only. The visitors affected would be primarily backcountry users, with local closures and restrictions affecting some itineraries and the trip quality for these visitors. Wildland Fire Use would enhance the recreation experience for some users, while it would negatively affect the visit for others, because of the perceived risks and the changes required in trip itineraries. Some visitors would be redirected to other parts of the park during closures. However, because visitation levels in the backcountry during peak periods are not that great, very few visitors would be impacted. For those who were affected, there would be an adverse, short-term and major affect on a small proportion of park visitors.

The majority of park visitors would be affected only by the smoke from Wildland Use Fires, and this would typically occur when down slope and down- valley winds carry smoke into the low-lying basins and drainages, generally during night- time and early morning hours. The visitors affected would mainly be the overnight campers, which would represent over one third of the visitors to Whiskeytown during peak visitation periods in the summer months. However, smoke would potentially remain in the area all through the day, affecting visibility of some scenic views in the park (see Viewshed/Aesthetic Resources). These impacts on all park visitors would be potentially adverse, short- term and moderate. Wildland Fire Use would be common during the peak season thus smoke impacts would potentially impact a large number of visitors.

A side effect of wildland fire use would be the possibility of increased helicopter use during such incidents. Helicopter use would create human- caused noise and the need to clear spots for safe landings and operations. The adverse and moderate impacts of noise and activity would be short- term, and during the period when the fire was staffed and/or monitored.

This alternative includes the use of Level 3 mechanical treatment (small- scale logging), which could have impacts upon recreation. This form of biomass removal would affect visitors through

localized safety closures and equipment noise in Fire Management Unit 1 (Front country) and selected areas in FMU 2. Visitors would, however, be able to partake in their activity, including hiking, biking, and scenic touring, in another, nearby location, with limited or no restrictions. Some visitors would have concerns about equipment use in the national park, while others would understand the rationale for its use and would be supportive. Overall, the impacts upon recreation would be adverse, short- term and minor.

Under Alternative IV, there would be no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative IV are the same as those discussed in Alternative I

Conclusion

None of the Alternatives would cause impairment of recreational opportunities. All alternatives have potential to cause short- term localized adverse impacts to recreational use, but these impacts would be transient. Alternatives that restore and maintain more of the park ecosystems in a naturally functioning state would provide the best quality environment for visitors, as well as optimize opportunities for educational and scientific pursuits.

Visual Resources

Impacts and issues common to all alternatives

Each of the alternatives includes fire management activities which may cause both short- term and long- term impacts depending on location and time of year. These impacts may have both direct and indirect impacts on the visitor. Direct impacts include the visual impacts of hand lines, shaded fuel breaks, and mechanical treatment work as well as the post- fire impacts such as mortality of trees and scorching of foliage and charring of bark, especially along roadways and in developed areas. Indirect impacts include the impacts on park visitation and the memories of park visitors impacted by the sight of large, high severity wildland fires.

Under all alternatives, large, high- intensity, high severity fires are likely to occur throughout the park until the majority of the park is restored to its natural function. Because fires have been, and would continue to be, suppressed, fuels build up and the plant community structure changes. It is unlikely that this situation would change during the life of this revised Fire Management Plan. If the result of these conditions resulted in a large, high severity fire, there may be a major impact on scenic quality. In this case, the impact on scenic quality would be adverse, long- term and major under all alternatives.

The impacts of prescribed fire are viewed differently by the visiting public. Both the direct and indirect impacts of charred vegetation are the same under all alternatives. Under normal burning conditions, prescribed burns normally result in a mosaic burning pattern where the vegetation grows back shortly after the burn. Chipping would result in local area impacts that would be limited to evidence of activity, through the concentrations of wood chips left behind. Chipping would not be a major feature on a landscape/scenic view scale. These impacts would be adverse, short- term and negligible.

The majority of fuels generated from shaded fuel break and prescribed fire site preparation are piled on site and burned at a later time. This activity has two potential impacts on scenic resources. First, piles of stacked fuels would be visible, and potentially within major scenic views. Second, burned piles would leave a pattern of burned area that would not appear natural. Both impacts would be adverse, short- term and minor.

Relocation of the fire cache and construction of a new administrative building in the present park headquarters compound will not have any adverse impacts to viewsheds, per se—though the construction of a new administrative building could mean improved aesthetics from the removal of several buildings that lack any architectural style or continuity with the landscape. The construction of a new building would be completed with a site design that incorporates an appreciation of the greenspace in the headquarters area. The relocation of the fire cache would be completed in an area currently occupied by a storage building and fire engine bay. There is not expected to be any adverse impacts to viewsheds, though a similar argument for the improvement of aesthetic values could be made by improved site designs that integrate greenspace and native plantings.

Methodology

Fire management activities and operations, high severity fire and smoke from fire sources are evaluated for their potential to affect scenic quality in major scenic views, such as Whiskeytown Lake, along road corridors, and in undeveloped areas of the park. Under this topic, the alternatives are evaluated on what may be considered a more subjective basis, as the impacts are not quantifiable as they are in other areas.

Type

Adverse – Impacts would be considered adverse if the visual quality would be degraded.

Beneficial – Impacts would be considered beneficial if the visual quality would be improved.

Duration

Short-term – Short-term impacts would be short-lived or temporary, occurring primarily during fire management treatment activities (wildland fire use, prescribed fire, biomass removal, etc.), or just shortly thereafter.

Long-term – Long-term impacts would be permanent or continual - in other words, the impacts would continue well after the activity period for the treatment.

Intensity:

Negligible – Imperceptible or undetectable.

Minor – Minor impacts would be slightly detectable or localized within a relatively small area.

Moderate – Moderate impacts would be those that are readily apparent.

Major – In areas of scenic value, major impacts would be substantial, have highly noticeable impacts and/or result in changing the character of the landscape.

Alternative I

This alternative continues the current fire management program. There would continue to be visual impacts from already-planned shaded fuel break construction projects, prescribed burns, wildland fires, and post-burn fire impacts. As in other areas of impact analysis, the potential impacts from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. Alternative I proposes localized strategies to reduce hazardous fuel conditions in Whiskeytown National Recreation Area.

The greatest potential for high severity fires would be in Fire Management Unit (FMU)1 and along the margins of FMU 1, the suppression area of the park. All of the park developed areas as well as the Shasta Divide area on the eastern boundary are all within or along FMU 1, and forest conditions around each of these areas are among the most changed in the park, due largely to past and successful fire suppression activities. The impacts of high severity fire on scenic quality in these areas would be adverse, long- term and major. Under this alternative, the potential for more fires of significant size and intensity would remain high. If fires occurred along major road corridors, or near scenic vistas, the impacts would be adverse, major, and potentially long- term.

Prescribed fire can be used as a tool to maintain or minimize impacts to the sensitive scenic resources, such as in the developed areas and highly visible areas around Whiskeytown Lake. It can also have impacts that would be considered potentially adverse to the front country visitor that is an infrequent visitor to parks and natural areas. Fire would be infrequently prescribed as a tool for maintaining open scenic views, and this would generally be incidental to accomplishing vegetation management objectives. This acreage would only be a small portion of the 1,400 acres treated per year on average, and most would be in either Brandy Creek, Oak Bottom, or Whiskey Creek. Prescribed burning could also be used to reduce fuel loadings and mitigate severe wildland fire impacts to the visual resource. Some would see the local impacts of burning as adverse, but public acceptance of the prescribed fire program has increased to the point that local impacts would not be seen as adverse by most. Impacts of prescribed burning on scenic resources would be generally beneficial and long- term, but minor, because of the limited number of acres treated.

This alternative only includes mechanical treatment level 1, so there would not be any whole tree removal or brush mastication by mechanical means. Actions associated with shaded fuel break and prescribed fire unit boundary construction, and mechanical treatment would be visible to visitors within the immediate area of work, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be adverse, short- term, and minor. Hand thinning is not currently used as a tool to restore and maintain open vistas in Whiskeytown, but chipping could be used to dispose of cut vegetation. Chipping would result in local area impacts that would be limited to evidence of activity, through the concentrations of wood chips left behind. Chipping would not be a major feature on a landscape/scenic view scale. These impacts would be adverse, short- term and negligible.

Cumulative Impacts

There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long- term and minor.

Considered in combination with these impacts, the impact of Alternative I, No Action on scenic resources would remain beneficial, long- term and minor.

Alternative II

The impacts of this alternative on scenic resources would be similar to that of the No Action Alternative, except in the following areas:

Under this alternative, prescribed fire would be significantly increased and could be used as a tool for restoring and maintaining scenic resources. Although Whiskeytown does not have any specific plans in place to address scenic vistas, there are areas in which prescribed fire could be employed to improve aesthetics and vistas. This acreage would only be a small portion of the 3,000 acres per year treated on average, but the actions would clear scenic views of forests that have become overstocked and degraded over the past century. Prescribed fire would also cause impacts that would be considered adverse to some front country visitors, so education efforts would be needed to explain objectives and the role of fire in natural systems. However, public acceptance of the prescribed fire program has increased to the point that local impacts would not be seen as adverse by most visitors. Impacts of prescribed burning on scenic resources would be generally beneficial and long- term, but moderate to major.

Through the use of prescribed fires, areas with sensitive visual resources can be protected from fire and certain fire suppression activities. Fires could also be managed to produce a lower intensity fire, resulting in minimal change to the scenery. Firelines around prescribed fire unit boundaries would be cut but not maintained as the shaded fuel breaks would be. These actions would be visible to visitors within the immediate area, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be greater than under No Action, due to the greater number of treated acres under this alternative. On the ground, visual impacts would be adverse, short- term and minor, but would contribute to beneficial, long- term and major impacts through the restoration of open scenic views.

As in No Action, this alternative only includes mechanical treatment level 1, so there would not be any whole tree removal or brush mastication by mechanical means. Actions associated with shaded fuel break and prescribed fire unit boundary construction, and mechanical treatment would be visible to visitors within the immediate area of work, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be adverse, short- term, and minor. Hand thinning is not currently used as a tool to restore and maintain open vistas in Whiskeytown, but chipping could be used to dispose of cut vegetation. These impacts would be adverse, short- term, and minor.

Pile burning would occur on cut firelines as the primary method of brush disposal but on a much smaller scale than in No Action. The piles of stacked fuels would be visible in the immediate area of work, and potentially within some scenic views. When burned, the piles would leave a pattern of burned area that would not appear natural. As in No Action, both impacts would be adverse, short- term and minor, but the amount and distribution of work would decrease substantially under this alternative due to the fact that there would be no additional shaded fuel break construction as in the other alternatives.

Cumulative Impacts

There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long- term and minor.

Considered in combination with these impacts, the impact of Alternative II on scenic resources would remain beneficial, long- term and moderate.

Alternative III

The impacts of this alternative on scenic resources would be similar to that of the No Action Alternative, except in the following areas:

This alternative eliminates the adverse short- term visual impacts (scorching of foliage and charring of bark) resulting from numerous smaller and frequent prescribed fires. Infrequent, high intensity fires which would occur over the long- term would result in drastic changes in the visual appearance of the affected area. Some unsightly and potentially long- lasting scars from fire suppression activity (i.e. fire lines, stumps, pink colored retardant, etc.) may also result, even under the most carefully conducted fire suppression operations.

Under this alternative, prescribed fire would be significantly decreased and shaded fuel break construction would be significantly increased. Only a very small percentage of the 250 acres of prescribed fire per year planned under this alternative would likely target scenic vistas, compared to the 1,400 acres per year treated per year under No Action. Impacts of prescribed burning on scenic resources would be generally beneficial and long- term, but moderate to major.

This alternative would increase the number of acres targeted for shaded fuel break construction to 1,100 acres per year and result in wider shaded fuel breaks than under the No Action alternative. Although vegetation would be left on site during the construction of the shaded fuel breaks, they could be more visible to others besides those in the immediate area of work, but generally would not be visible from scenic vistas within the park. Impacts would be adverse, short- term and minor.

Mechanical treatment level 2 would be utilized in this alternative to reduce fuels with brush reduction machinery. In an average year, 450 acres would be treated. The activity would have at least two potential impacts. First, the act of shredding vegetation and leaving it in place would result in on- the- ground impacts, such as fuel piles, vehicle tracks and soil disturbance that would have adverse impacts. Some evidence of activity, such as stump cuts, would be potentially long- term. However, with mitigation such as clean- up activities at the end of the project (raking out vehicle tracks and soil disturbance), most of these impacts would be short- term, minor and adverse. Second, biomass removal would restore forest stands to a target condition (when applied in combination with prescribed fire) that would be within the natural range of variability for the system. This would have the beneficial affect of opening up views and improving scenic quality on a landscape basis. This effect would be beneficial, long- term and potentially major, yielding benefits that would not occur under the No Action alternative.

Pile burning would occur on cut firelines and shaded fuel breaks as the primary method of brush disposal but on a much larger scale than in No Action. The piles of stacked fuels would be visible in the immediate area of work, and potentially within some scenic views. When burned, the piles would leave a pattern of burned area that would not appear natural. As in No Action, both impacts would be adverse, short- term and minor, but the amount and distribution of work would increase substantially under this alternative due to the fact that there would be additional shaded fuel breaks constructed.

Cumulative Impacts

There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long- term and minor.

Considered in combination with these impacts, the impact of Alternative III on scenic resources would remain beneficial, long- term and moderate.

Alternative IV

This alternative would result in more natural and variable impacts of fire as a result of Wildland Fire Use tactics being employed. The impacts of this alternative on scenic resources would be similar to Alternatives II and III, with their emphasis on prescribed burning and shaded fuel break construction and mechanical treatment, respectively, except in the following areas:

In the backcountry areas of the park (FMU 2), a broader range of visual impacts would be allowed to occur, due to the use of Wildland Fire Use strategies and large- scale mechanical treatment projects being utilized. Small Wildland Fire Use fires would result in a mosaic pattern of burned and unburned patches of vegetation. To some, the affect of Wildland Fire Use on scenic resources would be seen as adverse, but to most backcountry visitors the impacts would be seen as acceptable, beneficial and natural. Fire in Whiskeytown plant communities that are within their natural range of variability rarely result in extreme events with major impacts on scenic quality, although the potential certainly exists. The typical impacts of fire include blackened bark, cat faces on some trees, the opening of the understory, cleaning (through burning) of the litter and duff layer, and the scorching of some trees, resulting in scattered kill and opening of the canopy. It is likely that backcountry users would see these natural impacts as beneficial, long-term and major on a landscape scale.

In developed areas and along boundaries, prescribed fire would be used to minimize the impacts to the sensitive visual resources. The use of prescribed burning to reduce fuel loadings would mitigate severe wildland fire impacts to the visual resource. Impacts from tactics to control wildland fires and prescribed fires would be similar to Alternative I.

This alternative is the only alternative that utilizes mechanical treatment level 3, which includes the use of tracked and tired logging equipment. In an average year, 640 acres would be treated. The activity would have at least two potential impacts. First, the act of cutting vegetation and removing it would result in on- the- ground impacts, such as stump cuts, fuel piles, vehicle tracks and soil disturbance that would have adverse impacts. Some evidence of activity, such as stump cuts, would be potentially long- term, unless additional actions (tub grinders, for example) are used. However, with mitigation such as clean- up activities at the end of the project (raking out vehicle tracks and soil disturbance), most of these impacts would be short- term, minor and adverse. Second, biomass removal would restore forest stands to a target condition (when applied in combination with prescribed fire) that would be within the natural range of variability for the system. This would have the beneficial effect of opening up views and improving scenic quality on a landscape basis. This effect would be beneficial, long- term and potentially major, yielding benefits that would not occur under the No Action alternative.

Cumulative impacts for Alternative IV are the same as those discussed in Alternative I.

Considered in combination with these impacts, the impact of Alternative IV on scenic resources would remain beneficial, long- term and moderate.

Conclusion

Fire management activities would affect scenic resources in generally beneficial ways, through actions that would contribute to restoring and maintaining open vistas and natural forest structure conditions. Alternative I would continue to have a high potential for major, adverse and

long- term impacts. If high severity fire were to cause major impacts to areas surrounding the lake and high- visibility areas, the impact would be considered impairment. The intent of Alternatives 2 and 3 is to reduce the risk of high severity fire, thus there would be no impairment from the impacts of these alternatives. The impacts in Fire Management Unit 1 would be greatest in Alternative IV due to the larger amounts of annual accomplishments in biomass treatment and prescribed fire. Overall, these impacts would be beneficial, long- term and major, especially if projects in some areas included objectives related to the restoration and maintenance of open vistas. Under Alternative IV, there would be a lesser likelihood of having large, high intensity high severity fires. The potential for high severity fire still exists, but the intent of the alternative is to reduce the risk, eliminating any impairment from the impacts of this alternative.